United States
Department of
Agriculture

Research, Education,
and Economics

Agricultural
Research
Service

Washington, D. C.

Agricultural Research Service FY 2000

Explanatory Notes

2000 Explanatory Notes
Agricultural Research Service

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AGRICULTURAL RESEARCH SERVICE

Purpose Statement

The Agricultural Research Service (ARS) was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

The research performed by ARS is authorized by the Department of Agriculture Organic Act of 1862 (7 U.S.C. 2201, 2204), the Research and Marketing Act of 1946, amended (7 U.S.C. 427, 1621), the Food and Agriculture Act of 1977, as amended (7 U.S.C. 1281 note), the Food Security Act of 1985 (7 U.S.C. 3101 note), and the Food, Agriculture, Conservation, and Trade Act of 1990 (7 U.S.C. 1421 note), Federal Agriculture Improvement and Reform Act of 1996 and Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Act, 1999.

The mission of ARS research is to develop new knowledge and technology which will ensure an abundance of high quality agricultural commodities and products at reasonable prices to meet the increasing needs of an expanding economy and to provide for the continued improvement in the standard of living of all Americans. This mission focuses on the development of technical information and technical products which bear directly on the need to: (1) manage and use the Nation's soil, water, air and climatic resources, and improve the Nation's environment; (2) provide an adequate supply of agricultural products by practices that will maintain a permanent and effective agriculture; (3) improve the nutrition and well-being of the American people; (4) improve living in rural America; and (5) strengthen the Nation's balance of payments. The research applies to a wide range of goals; commodities; natural resources; fields of science; and geographic, climatic and environmental conditions.

As the Department of Agriculture's largest in-house research agency, ARS has major responsibilities for conducting and leading the national agricultural research effort. ARS provides initiative and leadership by providing:

* Research on broad regional and national problems.
* Research to support Federal action and regulatory agencies.
* Expertise to meet national emergencies.
* Scientific resources to the Executive Branch and Congress.

ARS is responsible for conducting research under each of the following major program activities:

- Research to develop new knowledge to better manage and enhance the Nation's soil, water, and atmospheric resources to optimize agricultural productivity and environmental quality.
  Conserving and enhancing the Nation's soil, water, and air resources requires the development of guidelines that evaluate the impact of current practices and assesses the potential effect of changing practices on the quality and productive capacity of these resources. Research stresses the discovery of knowledge and its integration into agricultural land management systems that can be used to maintain and enhance farm profitability while reducing or reversing adverse impacts on long-term productivity and the environment. Management practices are being developed that make better use of available water resources, enhance soil quality and reduce erosion, improve nutrient use efficiency, and provide an optimum environment for crop growth: protect the quality of the Nation's water resources and conserve its quantity; and that are economically viable. Improved understanding of the effects of global change on the natural resources are stressed, as is devising appropriate response measures to global change. The impact of air quality on agricultural production and the effect of agricultural practices on air quality and sustainability of agricultural systems are evaluated in the research programs.

- Research to expand the knowledge and technology base necessary to maintain and increase the productivity and quality of crop plants.
  This research places emphasis on improving the efficiency of crop production and the quality of market products to meet processor and consumer needs, and maintaining and improving the competitiveness of U.S. agricultural products in the domestic and world markets. Research is conducted on a broad range of crops including grains, oilseeds, sugar crops, fruits, vegetables, ornamentals, forage, range, and industrial crops. The National Plant Germplasm System provides the foundation for genetic improvement and encompasses the acquisition, preservation, evaluation, and enhancement activities necessary to properly utilize plant germplasm. Biologically-based technologies are being used in integrated pest management systems to protect plants from diseases, insects, and weeds with reduced dependence on agricultural chemicals. Special emphasis is placed on sustainable agricultural production systems that are effective, profitable, and protective of soil, air, and water resources.

- Research to provide new knowledge and technology to maintain and increase productivity and quality of animals and animal products.
  The research program places primary emphasis on improving the efficiency of livestock, poultry, and aquaculture production while simultaneously improving the quality of the end product. The total effort is designed to solve both short and long-term, high priority national problems and to address the needs of action and regulatory agencies. Major thrusts include improving the productivity of animals; assuring the quality and safety of animal products used as food for humans; and reducing losses due to pathogens, diseases, parasites, and insect pests. To accomplish these goals, new technology innovations are needed to preserve and effectively utilize animal germplasm; understand how specific genes improve production, reproduction, and animal product quality; enhance genetic resistance to diseases; improve techniques to rapidly diagnose, prevent, manage, or eliminate diseases, parasites, and insect pests: and detect and control microbial and chemical residue contamination in live animals and animal products. Research is currently underway to more rapidly change genetic makeup of animals and improve reproductive efficiency and growth potential; improve the nutritional components of animal feedstuffs; genetically reduce lipids in animal products; develop genetically engineered vaccines for protection against pathogens, diseases, parasites, and insect pests; develop new, rapid, and accurate methods of disease diagnosis; improve the safety of animal food products; develop integrated management technologies for insect pests and disease vectors; improve the well-being and humane care of farm animals in production facilities; and develop the means to manage and utilize animal wastes to reduce contamination of surface and groundwater.

- Research to develop and expand technologies necessary to achieve maximum use of agricultural commodities in domestic markets and exports.
  Increasing the economic viability of rural communities and competitiveness of U.S. agriculture by enhancing the quality, assuring the safety, and increasing the use of agricultural materials in products for domestic and global markets is paramount in determining postharvest research strategies.

  Food Safety--Reduction in potential risks for consumers caused by human pathogens in food is a core focus of ARS' food safety program. Much of this research is devoted to all aspects of preharvest and postharvest pathogen reduction. Reduction in risks from naturally-occurring toxicants, mycotoxins, and chemical residues in the food supply is the other major thrust of food safety research. These activities lead to reduced health risks for consumers, and enhanced economic opportunities for farmers and processors.

  Commodity Quality-- Maintenance and enhancement of the quality of U.S. commodities are key factors to increasing domestic and foreign market demand. Technologies to assess and maintain the important physical, sanitary, and performance characteristics of agricultural commodities are essential to enhanced economic opportunities and global competitiveness.

Trade and Quarantine Barriers--Processes to eliminate or control postharvest insects and spoilage organisms are crucial to enhance economic opportunities for U.S. commodities by overcoming regulatory and quarantine trade barriers. Emphasis in the ARS program is on the development of acceptable treatment technologies for agricultural commodities that meet regulatory and quarantine requirements. This enhances global competitiveness and economic opportunities for the U.S. agricultural system, while protecting the environment by devising alternatives to the use of ozone depleting fumigants such as methyl bromide.

New Uses and Process Improvement--The core program has three segments: (1) new products and processes based on vegetable oils, animal fats, oilseed and grain proteins, carbohydrates (starch), and established fibers (cotton and leather); (2) uses for new crops not now grown on a significant scale in the U.S. (guayule, jojoba, lesquerella, kenaf, flax); and (3) biofuels, principally ethanol made from high starch crops and biodiesel made from vegetable oil (soybean) and animal fats. The focus of this research is lower cost processing technologies and new products from agricultural crops to meet domestic and global demands, thus expanding U.S. economic opportunities and enhancing global competitiveness.

- Research to develop new technology essential to improve human health and well-being through improved nutrition.

  USDA has the primary responsibility for developing the fundamental information on human nutrition requirements which provide the basis for development of dietary guidelines and for food assistance programs. As the Federal government's lead agency for human nutrition research, ARS activities are directed toward understanding the effects of diet on healthy human volunteers of all ages. The objectives of the research are to improve human health by defining nutrient requirements to enable robust physical and mental function and resistance to disease and aging degeneration. Other functions of the ARS research include determination of food consumption patterns, development of nutritional status assessment technologies, assessment of nutrient composition of foods, and maintenance of the national Nutrient Database, a compendium in printed and electronic form of available information. Research on strategies to effect public acceptance of change in dietary habits is a new initiative, with regional emphasis on the Lower Mississippi Delta. The knowledge derived from these activities provides multiple benefits to the Nation, in a healthy population, reduced health care costs, longer active life spans, cost-effective food assistance, and improved life.

- Integrate knowledge of agricultural production, processing and marketing into management systems which optimize utilization of users' resources and net returns.

  Finding solutions to important national problems faced by agriculture requires the integration of components of research from all areas of the agricultural and natural resource system. These components include soils, water, climate, plants, animals, insects, diseases, weeds, and people. This research evaluates the interaction of many components that constitute a system, including an agroecosystem, a watershed, or a farm. Systems research integrates results into products that aid or improve the timeliness and pertinence of decisions made by managers of agricultural systems. Discovery and understanding critical gaps in knowledge that can be integrated from ongoing component research into further refinements of systems is a critical aspect of these efforts. Systems research leads to reduced input costs, higher returns, improved product quality, more efficient resource use, reduced environmental impact, and improved sustainability of agricultural production systems that meet long-term societal needs. This research requires multi-disciplinary efforts often located throughout the United States. Team members are linked through national information networks to share concepts and databases required to build and evaluate models. Mathematical models are one of several techniques used to describe real systems. Experiments are performed to understand the system's response over time to alternative environments or management practices. Decision support systems can be devised that integrate available knowledge, simulation models, records of personal experience and observations, and error analysis into systems that permit a manager to compare and evaluate management options.

- Identify, acquire, organize, preserve, and disseminate pertinent food and agricultural information. Overall, the thrust of the National Agricultural Library (NAL) activities is to utilize computer and electronic technologies to provide access to scientific and agricultural information, irrespective of where it resides, to USDA, public organizations and individuals. To this end, NAL is addressing within its strategic plan how it will provide global leadership in identification and implementation of new methods, techniques and technologies to improve access to and management of agricultural information.

  NAL activities continue to rely heavily on incorporation of electronic technologies. NAL has embraced many of the new information technologies and, as a result, many individuals within the agricultural community look to NAL to lead agricultural libraries into the electronic age. Support of the Electronic Information Initiative and Digital Preservation of older materials, has assisted in NAL's progress into the electronic information age.

In addition, ARS appropriated funds are also expended in support of the following:

- Repair and maintenance of facilities. Funds are used to repair and maintain ARS facilities to provide safe, energy-efficient and functional workspace for in-house research. ARS is committed to adequately funding routine maintenance and repair to assure that all facilities are properly maintained. Each location also allocates program funds, as appropriate, to perform the most urgent repairs or maintenance of facilities.

- Contingencies. These funds, established by Congress in fiscal year 1962, provide for contingency financing of urgent items requiring immediate research action, including research demanded by emergency situations, unforeseeable research needed because of unexpected scientific breakthroughs, damaged but urgently needed facilities, and other related needs where time is of the essence.

The Department has a central fund to promote facility compliance under the requirement of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation Recovery Act (RCRA). These Acts require Federal agencies to meet the same standards for storage and disposition of hazardous wastes as private businesses. The funds provided for this program enable the Department to address problems posed by past uncontrolled hazardous waste disposal practices and to deal with the regulation of current hazardous substances. Resources are allotted to USDA agencies from the central fund. The Agency supplements these funds as necessary.

ARS' Headquarters offices are located in the Washington, D.C. metropolitan area. The field activities are managed on a national basis through eight Area Offices. Research is conducted at field locations in the United States, District of Columbia, Puerto Rico, the Virgin Islands, and in three foreign countries. Much of the work is conducted in direct cooperation with State agricultural experiment stations, other State and Federal agencies, and private organizations.

As of September 30, 1998, there were 6,292 full-time employees and 1,606 other than full-time employees. Of the total 426 full-time employees and 32 other than full-time employees worked in the Headquarters offices.

During FY 1998 the following GAO and OIG reports were completed:

- GAO Audit: "USDA Information on the Condition of the National Plant Germplasm System" - In FY98 RCED-98-20 was published in 10/97.

- GAO Audit: "Role of Tobacco Industry in the U. S. Economy" - In FY98 RCED 98-110 was published on 4/15/98.

- GAO Audit: "Agriculture Exports: U. S. Needs a More Integrated Approach to Address Sanitary/Phytosanitary Issues" - In FY98 NSIAD-98-32 was published on 12/11/97.

- OIG Audit (50601-3-At): "Radioactive Materials and Waste Management" - Published on 3/31/98.

- OIG Audit (50601-5-At): "CSREES and ARS Facilities Construction Grants" - Published on 9/30/98.

- OIG Audit (50099-5-Hy): "USDA Payroll and Personnel System" - Completed in FY98 as (50099-11-FM) "Review of ARS Payroll/Personnel and Time and Attendance System" in 8/98.

Other audits which have not been completed:

- GAO Audit: "Review of Agencies' Peer Review of Scientific Research" (GAO Assignment Code RCED 141231)

- GAO Audit: "Price Premiums Paid on Best Value Buys" (GAO Assignment Code NSIAD 707345)

AGRICULTURAL RESEARCH SERVICE

Available Funds and Staff Years

1998 Actual and Estimated 1999 and 2000

Item	1998 1/ Actual		1999 2/ Estimated		2000 Estimated	
	Amount	Staff Year	Amount	Staff Year	Amount	Staff Year
Salaries and Expenses	$745,155,000	7,224	808,518,000	7,555	$836,868,000	7,555
Rescission	-223,000	--	--	--	--	--
Transfer from Office of Civil Rights	169,618	--	--	--	--	--
Transfer from Department of State	16,000	--	--	--	--	--
Transfer from OSEC for Congressional Relations	129,000	--	--	--	--	--
Transfer from Office of National Drug Control Policy (ONDCP)	--	--	4,500,000	--	--	--
Adjusted Agricultural Research Service	745,246,618	7,224	813,018,000	7,555	836,868,000	7,555
Buildings & Facilities	80,630,000	--	56,437,000	--	44,500,000	--
Total, Appropriations	825,876,618	7,224	869,455,000	7,555	881,368,000	7,555
Deduct Allotments to Other Agencies:						
Forest Service	-223,144	--	--	--	--	--
Net	825,653,474	7,224	869,455,000	7,555	881,368,000	7,555
Allocations from:						
Hazardous Waste Mgmt	4,040,311	--	3,666,000	--	4,145,000	--
Obligations under Other USDA Appropriations:						
Agricultural Marketing Service	345,791	1	451,000	1	451,000	1
Animal and Plant Health Inspection Service	6,663,129	23	8,695,000	23	8,695,000	23
Cooperative State Research, Education and Extension Service	3,893,120	14	5,080,000	14	5,080,000	14
Economic Research Service	3,968,834	14	5,180,000	14	5,180,000	14
Farm Service Agency	25,062	--	33,000	--	33,000	--
Food, Nutrition, and Consumer Services	33,027	--	43,000	--	43,000	--
Food Safety and Inspection Service	1,387,142	5	1,810,000	5	1,810,000	5
Foreign Agricultural Service	788,516	2	1,029,000	3	1,029,000	3
Forest Service	831,476	3	1,085,000	3	1,085,000	3

Available Funds and Staff Years

1998 Actual and Estimated 1999 and 2000

Item	1998 1/ Actual		1999 2/ Estimated		2000 Estimated	
	Amount	Staff Year	Amount	Staff Year	Amount	Staff Year
Other USDA Funds (continued)						
National Agricultural Statistics Service	3,059,082	11	3,992,000	10	3,992,000	10
Natural Resources Conservation Service	1,372,631	5	1,791,000	5	1,791,000	5
Office of the Chief Economist	460,000	2	600,000	2	600,000	2
Rural Development	100,000	--	131,000	--	131,000	--
Miscellaneous, Reimbursements	1,280,557	--	1,671,000	--	1,671,000	--
Total, Other USDA Appropriations	28,248,678	80	35,257,000	80	35,736,000	80
Total Agriculture Appropriations	853,902,152	7,304	904,712,000	7,635	917,104,000	7,635
Other Federal Funds:						
Department of Commerce	72,220	--	94,000	--	94,000	--
Department of Defense	1,774,377	6	2,316,000	6	2,316,000	6
Department of Energy	1,336,169	5	1,744,000	5	1,744,000	5
Department of Health and Human Services	2,496,370	9	3,258,000	9	3,258,000	9
Department of the Interior	502,640	2	656,000	2	656,000	2
Department of Justice	26,500	--	35,000	--	35,000	--
Environmental Protection Agency	2,013,689	7	2,628,000	7	2,628,000	7
National Aeronautics and Space Administration	675,558	2	882,000	2	882,000	2
National Institute of Alcohol and Alcohol Abuse	199,994	1	261,000	1	261,000	1
National Oceanic and Atmospheric Administration	60,131	--	78,000	--	78,000	--
Miscellaneous Other Federal	297,929	--	389,000	--	389,000	--
Non-Federal Funds:						
Almond Board of California	38,875	--	51,000	--	51,000	--
Arkansas, University of	47,324	--	62,000	--	62,000	--
Binational Agricultural Research and Development Agreement (BARD)	168,255	1	220,000	1	220,000	1

Available Funds and Staff Years

1998 Actual and Estimated 1999 and 2000

Item	1998 1/ Actual		1999 2/ Estimated		2000 Estimated	
	Amount	Staff Year	Amount	Staff Year	Amount	Staff Year
Non-Federal Funds: (continued)						
Biotechnology Research and Development Cooperation (BRDC)	11,600	--	15,000	--	15,000	--
California Department of Food and Agriculture	260,321	1	340,000	1	340,000	1
California, State of	79,885	--	104,000	--	104,000	--
California, University of	10,249	--	13,000	--	13,000	--
Clemson University	34,204	--	45,000	--	45,000	--
Colorado State University	11,888	--	16,000	--	16,000	--
Cotton Foundation	67,214	--	88,000	--	88,000	--
Cotton Incorporated	443,585	2	579,000	2	579,000	2
Florida, State of	432,256	2	564,000	2	564,000	2
Georgia, University of	117,456	--	153,000	--	153,000	--
Iowa State University	74,009	--	97,000	--	97,000	--
Kraft General Foods	149,618	--	195,000	--	195,000	--
Mississippi Department of Fisheries, Wildlife and Parks	43,305	--	57,000	--	57,000	--
Montana, State of	29,189	--	38,000	--	38,000	--
National Space Development Agency of Japan	99,316	--	130,000	--	130,000	--
Nature Conservancy	36,247	--	47,000	--	47,000	--
North Carolina State University	199,017	1	260,000	1	260,000	1
North Carolina, State of	32,027	--	42,000	--	42,000	--
North Dakota State University	20,230	--	26,000	--	26,000	--
Oregon Wheat Commission	31,422	--	41,000	--	41,000	--
Papio-Missouri River Natural Resources District of Nebraska	25,000	--	33,000	--	33,000	--
Quarters and Subsistence	182,341	--	238,000	--	238,000	--
Sale of Animals and Personal Property	746,415	--	974,000	--	974,000	--
South Carolina Foundation Seed Association	20,401	--	27,000	--	27,000	--
Southern Florida Water Management Districts	224,989	1	294,000	1	294,000	1
United Soybean Board	57,853	--	76,000	--	76,000	--

Available Funds and Staff Years

1998 Actual and Estimated 1999 and 2000

Item	1998 1/ Actual		1999 2/ Estimated		2000 Estimated	
	Amount	Staff Year	Amount	Staff Year	Amount	Staff Year
Non-Federal Funds: (continued)						
Vermont, University of.	22,902	--	30,000	--	30,000	--
Virginia Polytechnical Institute.	86,572	--	113,000	--	113,000	--
Washington Department of Ecology. . .	54,502	--	71,000	--	71,000	--
Water Environment Research Foundation.	43,613	--	57,000	--	57,000	--
Miscellaneous Non-Federal.	744,859	--	972,000	--	972,000	--
Miscellaneous Contributed Funds:	16,029,589	87	20,000,000	87	20,000,000	87
Total, Agricultural Research Service. . . .	884,034,257	7,431	943,121,000	7,762	955,513,000	7,762

1/ Includes $550,000 in USAID Funds.

2/ Includes $23 million supplemental drug control research funds.

Agricultural Research Service
Permanent Positions by Grade and Staff-Year Summary
1998 Actual and Estimated 1999 and 2000

	1998 Actual			1999 Estimate			2000 Estimate		
Grade	Head-quarters	Field	Total	Head-quarters	Field	Total	Head-quarters	Field	Total
ES-6	1	1	2	1	1	2	1	1	2
ES-5	2	3	5	2	3	5	2	3	5
ES-4	1	9	10	1	9	10	1	9	10
ES-3	2	7	9	2	7	9	2	7	9
ES-2	2	7	9	2	7	9	2	7	9
ES-1	3	2	5	3	2	5	3	2	5
GS/GM-15	41	446	487	41	446	487	41	446	487
GS/GM-14	29	542	571	29	542	571	29	542	571
GS/GM-13	90	614	704	90	701	791	90	701	791
GS-12	97	565	662	97	653	750	97	653	750
GS-11	18	515	533	18	515	533	18	515	533
GS-10	0	16	16	0	16	16	0	16	16
GS-9	25	777	802	25	777	802	25	777	802
GS-8	18	333	351	18	333	351	18	333	351
GS-7	38	604	642	38	779	817	38	779	817
GS-6	65	502	567	65	502	567	65	502	567
GS-5	18	383	401	18	383	401	18	383	401
GS-4	9	92	101	9	92	101	9	92	101
GS-3	3	17	20	3	17	20	3	17	20
GS-2	3	17	20	3	17	20	3	17	20
GS-1	2	3	5	2	3	5	2	3	5
Other Graded Positions.....	2	46	48	2	46	48	2	46	48
Ungraded Positions.....	1	527	528	1	527	528	1	527	528
Total Permanent Positions.....	470	6,028	6,498	470	6,378	6,848	470	6,378	6,848
Unfilled Positions End-of-Year	-44	-162	-206	-35	-178	-213	-35	-178	-213
Total Permanent Full-Time Employment, End-of-Year...	426	5,866	6,292	435	6,200	6,635	435	6,200	6,635
Staff Year Ceiling.....	463	6,968	7,431	463	7,299	7,762	463	7,299	7,762

AGRICULTURAL RESEARCH SERVICE
CLASSIFICATION BY OBJECTS
1998 Actual and Estimated 1999 and 2000

		1998 Actual	1999 Estimated	2000 Estimated
Personnel Compensation:				
Headquarters		$58,931	$64,054	$67,040
Field		276,378	302,143	314,301
11	Total Personnel Compensation	335,309	366,197	381,341
12	Personnel Benefits	75,828	85,624	89,160
13	Benefits for former employees	341	--	--
	Total, Pers. Comp. & Benefits	411,478	451,821	470,501
Other Objects:				
21	Travel and transportation of persons	13,853	15,453	16,600
22	Transportation of things	1,529	1,668	1,866
23.1	Rent payments to GSA	13	--	--
23.2	Rent paid to others	1,208	1,326	1,484
23.3	Communications, utilities and miscellaneous charges	30,424	32,000	33,695
24	Printing and reproduction	1,080	1,173	1,315
25.1	Advisory and Assistance services	203	203	203
25.2	Other services	40,205	45,856	42,308
25.3	Purchases of goods and services from Government accounts	4,211	4,227	4,504
25.4	Operation and maintenance of facilities	25,821	25,916	27,405
25.5	Research and development contracts	108,339	120,884	120,488
25.6	Medical Care	190	205	244
25.7	Operation and maintenance of equipment	8,118	8,149	8,683
25.8	Subsistence and support of persons	1,066	1,159	1,297
26	Supplies and materials	63,626	73,863	69,700
31	Equipment	38,927	40,075	41,819
32	Land and structures	15,573	48,931	43,145
41	Grants, subsidies, and contributions	23,129	15,774	16,883
	Total Other Objects	377,515	436,862	431,639
Total Obligations		788,993	888,683	902,140
Position Data:				
Average Salary, ES positions		$114,281	$118,395	$123,604
Average Salary, GS positions		$ 49,037	$ 50,800	$ 53,035
Average Grade, GS positions		9.6	9.6	9.6
Average Salary of Ungraded positions		$ 31,572	$ 32,709	$ 34,148

Note: Includes Salaries and Expenses and Buildings and Facilities Obligations.

AGRICULTURAL RESEARCH SERVICE

PASSENGER MOTOR VEHICLES

The Agricultural Research Service (ARS) passenger motor vehicle fleet is almost exclusively used by professional research investigators and technical personnel. In the course of their daily work, research personnel may need to travel to individual farms, ranches, commercial firms, State agricultural experiment stations, research fields, etc. In this type of work a high degree of mobility is necessary. Using common carriers is rarely feasible. Comparative studies of cost requirements involved in the use of private and Government vehicles have shown that it is more economical to have Government vehicles available than it is for reimbursement for using privately-owned vehicles.

It is ARS policy to pool the use of motor vehicles for different activities in order to keep the number of vehicles to a minimum and reduce overall costs of operation and maintenance. Vehicle operational reports are required and periodic surveys are made to determine the extent to which vehicles are being used and their condition.

Replacement of passenger motor vehicles. ARS proposes to replace 46 of the 377 passenger vehicles currently in operation. These vehicles are assigned to ARS locations and are used in connection with research studies and technical assistance. Vehicle replacement is based on funding priority, program management, vehicle mileage, and vehicle age. Federal regulations establish the minimum replacement standards that allow Agencies to replace passenger vehicles when the vehicle is 3 years of age or has 60,000 miles. Agencies can retain vehicles that meet the minimum replacement standards if the vehicle can be operated without excessive maintenance costs or substantial reduction in resale value.

Age and mileage data for passenger motor vehicles on hand as of September 30, 1998 are as follows:

Age Data			Mileage Data		
Age-Year Model	Number of Vehicles	Percent of Total	Lifetime Mileage	Number of Vehicles	Percent of Total
1993-5 or older	239	63	Over 100	14	4
1994-4	25	7	80-100	26	7
1995-3	36	9	60-80	46	12
1996-2	17	5	40-60	94	25
1997-1	46	12	20-40	117	31
1998	14	4	Under 20	80	21
Total	377	100	Total	377	100

AIRCRAFT

ARS currently maintains a fleet of six aircraft which are located at College Station and Weslaco, Texas. These aircraft have been specially modified and equipped for research for pest control methods, application of agricultural materials, radar tracking of airborne insect migration, infrared and color photography, and evaluating effects of weather on agriculture.

There are no planned replacements of these aircraft.

AGRICULTURAL RESEARCH SERVICE

The estimates include appropriation language for this item as follows (new language underscored; deleted matter enclosed in brackets):

Salaries and Expenses:

For necessary expenses to enable the Agricultural Research Service to perform agricultural research and demonstration relating to production, utilization, marketing, and distribution (not otherwise provided for); home economics or nutrition and consumer use including the acquisition, preservation, and dissemination of agricultural information; and for acquisition of lands by donation, exchange, or purchase at a nominal cost not to exceed $100, and for land exchanges where the lands exchanged shall be of equal value or shall be equalized by a payment of money to the grantor which shall not exceed 25 percent of the total value of the land or interests transferred out of Federal ownership, [$785,518,000] $836,868,000: Provided, That appropriations hereunder shall be available for temporary employment pursuant to the second sentence of section 706(a) of the Organic Act of 1944 (7 U.S.C. 2225), and not to exceed $115,000 shall be available for employment under 5 U.S.C. 3109: Provided further, That appropriations hereunder shall be available for the operation and maintenance of aircraft and the purchase of not to exceed one for replacement only: Provided further, That appropriations hereunder shall be available pursuant to 7 U.S.C. 2250 for the construction, alteration, and repair of buildings and improvements, but unless otherwise provided, the cost of constructing any one building shall not exceed $250,000, except for headhouses or greenhouses which shall each be limited to $1,000,000, and except for ten buildings to be constructed or improved at a cost not to exceed $500,000 each, and the cost of altering any one building during the fiscal year shall not exceed 10 percent of the current replacement value of the building or $250,000, whichever is greater: Provided further, That the limitations on alterations contained in this Act shall not apply to modernization or replacement of existing facilities at Beltsville, Maryland: Provided further, That appropriations hereunder shall be available for granting easements at the Beltsville Agricultural Research Center, including an easement to the University of Maryland to construct the Transgenic Animal Facility which upon completion shall be accepted by the Secretary as a gift: Provided further, That the foregoing limitations shall not apply to replacement of buildings needed to carry out the Act of April 24, 1948 (21 U.S.C. 113a): Provided further, That funds may be received from any State, other political subdivision, organization, or individual for the purpose of establishing or operating any research facility or research project of the Agricultural Research Service, as authorized by law. None of the funds in the foregoing paragraph shall be available to carry out research related to the production, processing or marketing of tobacco or tobacco products.

In the fiscal year [1999] 2000, the agency is authorized to charge fees, commensurate with the fair market value, for any permit, easement, lease, or other special use authorization for the occupancy or use of land and facilities (including land and facilities at the Beltsville Agricultural Research Center) issued by the agency as authorized by law, and such fees shall be credited to this account, and remain available until expended, for authorized purposes.

[“Agriculture Research Service”, Department of Agriculture, $23,000,000, for additional counterdrug research and development activities: Provided, That the entire amount is designated by the Congress as an emergency requirement pursuant to section 251(b)(2)(A) of the Balanced Budget and Emergency Deficit Control Act of 1985, as amended; Provided further, That such amounts shall be available only to the extent an official budget request for a specific dollar amount that includes designation of the entire amount of the request as an emergency requirement as defined in such Act is transmitted by the President to the Congress.]

The change deletes language authorizing $23,000,000 for additional counterdrug research and development. These funds were made available in 1999 as part of an emergency supplemental appropriation.

AGRICULTURAL RESEARCH SERVICE

Lead-Off Tabular Statement

SALARIES AND EXPENSES

Appropriations Act, 1999		$785,518,000
Budget Estimate, 2000		836,868,000
Increase in Appropriation		+51,350,000
Adjustments in 1999:		
Appropriations Act, 1999	$785,518,000	
Emergency Supplemental Appropriations for Counter Drug Research and Development	+23,000,000	
Transfer from the Office of National Drug Control Policy (ONDCP) for Anti-Drug Research and Related Matters	+4,500,000	
Adjusted Base for 1999		$813,018,000
Budget Estimate, 2000		836,868,000
Increase above Adjusted 1999		+23,850,000

AGRICULTURAL RESEARCH SERVICE

SUMMARY OF INCREASES AND DECREASES
(On basis of appropriation)

Item of Change	1999 Estimated	Pay Costs	Program Changes	All Other	2000 Estimated
Research on Soil, Water, and Air Sciences	$85,573,000	+$1,212,000	+$21,627,000	--	$108,412,000
Research on Plant Sciences	301,454,000	+3,982,000	-1,066,000	-$27,500,000 a/	276,870,000
Research on Animal Sciences	126,948,000	+1,867,000	+1,620,000	--	130,435,000
Research on Commodity Conversion and Delivery	162,217,000	+1,976,000	-3,240,000	--	160,953,000
Human Nutrition Research	68,446,000	+397,000	+20,015,000	--	88,858,000
Integration of Agricultural Systems	30,141,000	+258,000	+493,000	--	30,892,000
Agricultural Information and Library Services	19,048,000	+238,000	+1,971,000	--	21,257,000
Repair and Maintenance of Facilities	18,262,000		--	--	18,262,000
Contingencies	929,000		--	--	929,000
Total Available	813,018,000	+9,930,000	+41,420,000	-27,500,000	836,868,000

a/ Consists of the Emergency Supplemental Appropriations for Counter Drug Research and Development ($23 million) and the Transfer from the Office of National Drug Control Policy (ONDCP) for Anti-Drug Research and Related Matters ($4.5 million).

PROJECT STATEMENT
(on basis of adjusted appropriation)

	1998 Actual		1999 Estimated		Increase or Decrease	2000 Estimated	
	Amount	Staff Years	Amount	Staff Years		Amount	Staff Years
1. Research on Soil, Water, and Air Sciences	$84,414,246	864	$85,573,000	893	+$22,839,000 (1)	$108,412,000	966
2. Research on Plant Sciences	253,976,906	3,080	301,454,000	3,196	-24,584,000 (2)	276,870,000	3,107
3. Research on Animal Sciences	120,095,966	1,385	126,948,000	1,448	+3,487,000 (3)	130,435,000	1,460
4. Research on Commodity Conversion and Delivery	147,724,931	1,483	162,217,000	1,569	-1,264,000 (4)	160,953,000	1,526
5. Human Nutrition Research	70,345,205	258	68,446,000	268	+20,412,000 (5)	88,858,000	312
6. Integration of Agricultural Systems	28,138,082	187	30,141,000	198	+751,000 (6)	30,892,000	196
7. Agricultural Information and Library Sciences	19,572,300	174	19,048,000	190	+2,209,000 (7)	21,257,000	195
8. Repair and Maintenance of Facilities	17,635,590	--	18,262,000	--	--	18,262,000	--
9. Contingencies	-- a/	--	929,000	--	--	929,000	--
10. Collaborative Research Program	550,000 b/	--	--	--	--	--	--
11. Unobligated balance	2,793,392	--	--	--	--	--	--
Total Available or Estimate	745,246,618	7,431	813,018,000	7,762	+23,850,000	836,868,000	7,762
Transfer from Office of Congressional Relations	-129,000	--	--	--			
Transfer from Department of State	-16,000	--	--	--			
Transfer from Office of Civil Rights	-169,618	--	--	--			
Transfer from Agency for Int'l. Development (AID)	-550,000 b/	--	--	--			
Transfer from the Office of National Drug Control Policy (ONDCP) for Anti-Drug Research and Related Matters	--	--	-4,500,000	--			
Emergency Supplemental Appropriations for Counter Drug Research and Development	--	--	-23,000,000	--			
1998 Rescission	223,000	--	--	--			
Total Appropriations	744,605,000	7,431	785,518,000	7,762			

a/ Obligations incurred under the Research Contingency Fund in 1998 amount to $928,523 and are reflected in the program activities listed above.

b/ Collaborative Research Program Funds from AID are designated as no-year funds. Unobligated balance of $550,000 in 1998 is available for obligation in 1999.

AGRICULTURAL RESEARCH SERVICE

Justification of Increases and Decreases

OBJECTIVE 1: SOIL, WATER, AND AIR SCIENCES

1) A net increase of $22,839,000 for research on Soil, Water, and Air Sciences consisting of:

a) An increase of $1,212,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $6,300,000 for research in support of **Sustainable Ecosystems**.

ARS is a participant in the National Science and Technology Council, Committee on Environment and Natural Resources (CENR), Integrated Science for Sustainable Ecosystems Initiative. This collaborative effort is designed to enhance the scientific information necessary to sustain and manage the Nation's natural resources. Ecosystems are depended upon for clean air, clean water, agriculture and food, clothing, shelter, medicines, and aesthetic enjoyment. Effective management practices at national, regional, State, and local levels will ensure the availability of ecosystem goods and services over time. The CENR initiative emphasizes multiple stressors affecting land and resources, invasive species, pollution, extreme natural events, and atmosphere and climate change.

Outcomes

The proposed research is designed to significantly improve the understanding of ecosystems and the ability to manage them. ARS participation in the initiative will ensure an effective multidisciplinary approach to ecosystem sustainability and a practical link to transfer new science and technology to action agencies.

ARS research in these areas supports Performance Goal 1.2.1.2: experimentally demonstrate new and improved production, harvest, and postharvest handling procedures of crops; Performance Goal 2.1.2.1: demonstrate new integrated technologies to protect plants, animals and ecosystems; Performance Goal 4.1.1.1: demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base; Performance Goal 4.1.1.2: experimentally demonstrate the appropriateness of watershed-scale technologies and practices that protect the environment and natural resources; Performance Goal 4.1.3.1: demonstrate cropland and grazingland management strategies that improve productivity and efficiency of croplands and grazinglands; Performance Goal 4.2.1.1: risk-reduction strategies and methods transferred to the Nation's agricultural industry; Performance Goal 4.2.2.1: improve strategies and technologies that reduce the effects of extreme weather variability; Performance Goal 4.3.1.1: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment; and Performance Goal 4.3.2.1: demonstrate the effectiveness of integrated agricultural producing systems in the improvement of natural resources and protection of the environment.

Specific Program Thrusts

- **Implement the CENR Research and Monitoring Framework** ($300,000).
  Nonpoint sources of pollutants, such as runoff from agricultural, suburban, and urban areas contribute to environmental degradation. ARS, in cooperation with other CENR (Committee on Environment and Natural Resources) agencies, will select four or more watersheds where agricultural production contributes to soil, water, and air pollution. ARS is currently involved in the implementation of the

CENR Mid-Atlantic pilot of the National Environmental Research and Monitoring Framework. ARS plans to participate in a second fully integrated pilot in a region with substantially difficult ecosystem processes in year 2000. Farm and watershed-scale models and decision support systems will be used to recommend practices for managing the agricultural production and water systems. New cropping systems will be developed that reduce dependence upon inorganic fertilizers and pesticides, and use cover crops, smother crops, and new crop rotations. ARS will develop tools and assessment methods that farmers, ranchers, and other land managers can use to monitor soil quality.

- **Prevent and Control Eutrophication, Harmful Algal Blooms, and Hypoxia** ($4,100,000).
  Excess nutrients in coastal ecosystems increasingly affect fishery resources, coastal ecosystems, local economies, and public health. The nutrients lower water quality, alter the numbers and types of organisms, promote harmful algal blooms, stimulate bacterial growth, and reduce levels of oxygen. ARS will lead farm and watershed-scale research where agricultural production systems (including aquaculture) are a potential source of nutrients and pesticides in streams and rivers. Alternative options and strategies will be investigated to reduce nutrient transport to ground and surface waters, thus improving environmental quality and reducing public health hazards. Improved drainage water reuse strategies will be investigated to reduce drainage volumes and provide alternate agricultural management practices. Bioremediation management practices will be incorporated into the watershed-scale sites where appropriate.

- **Predict Ecological Impacts of Extreme Natural Events** ($500,000).
  Investigating ecosystem reactions to extreme events (e.g., hurricanes, windstorms, El Nino/La Nina episodes, floods, droughts, insect infestations) will provide a context for understanding and predicting the impact of extreme events, resulting in more effective responses. Research will focus on developing and validating models for predicting precipitation patterns over large watersheds, monitoring soil and crop conditions, and assessing changes in habitat. To more effectively respond to extreme natural events, research will focus on improving water management practices and developing better indicators of plant stress, and promoting more efficient use of water. Precipitation and temperature prediction tools will be developed that will provide the basis for new approaches to producer decisionmaking that minimize risk and stabilize production.

- **Predict Impacts and Restore the Viability of Damaged Riparian Zones and Coastal Habitats** ($800,000).
  Natural or constructed conservation buffers (riparian areas, wetlands, biofilters, and buffer strips) can remove sediments and contaminants generated by agricultural activities before they reach surface waters. The Clean Water Action Plan calls for farmers to create two million miles of biofilters adjacent to waterways by year 2002, construct 100,000 acres of wetlands by year 2005 and restore 25,000 miles of stream corridors by 2005 without knowing the capabilities of these practices. Research in this area will identify processes controlling the effectiveness of conservation buffers for removal of pollutants. This will require integrated knowledge of plants, microbial processes, soils, landforms, and hydrology. At present, knowledge and design options are limited.

- **Advance Ecological Science for Sustainable Livestock Management Systems** ($300,000).
  Manure management (i.e., handling, storage, reuse as a nutrient) will be researched to utilize nutrients more efficiently in crop and animal production systems to reduce excretion of nutrients that may adversely affect the environment. The effect of using different intensities or systems of pasture management and grazing intensities on rangelands, and the impact on the natural resource base and the environment will be researched. Research will focus on soil phosphorus in major U.S. soils and its movement into surface waters.

- **Conduct Integrated Ecosystem Risk Assessments** ($300,000).
  Risk assessment results provide a basis for comparing different management options, enabling decision makers and the public to make informed decisions about the management of ecological resources. ARS will play a lead role in the development of integrated management models and decision support systems for risk assessments that link experimental and observational studies across spatial scales to forecast ecosystem response to multiple stresses. Advanced irrigated and nonirrigated crop production systems, animal production and grazing lands systems, drainage systems, and other sustainable agricultural practices will be included in the models being developed to improve water quality, prevent soil erosion, reduce air pollution, conserve water, reduce energy requirements, and optimize agricultural production. Multiple stressors (changes in land and other resource uses, invasive species, pollution, extreme natural events, and climate change) also will be assessed and evaluated for their potential impacts on aquatic habitats, riparian zones, stream corridors, and wetlands in the selected sites.

c) An increase of $2,000,000 for research in support of **Air Quality**.

With the recent adoption of the National Ambient Air Quality Standards, the role of agriculture in polluting air is receiving greater attention. On January 31, 1997, the Secretary of Agriculture appointed a 19-member Agricultural Air Quality Task Force. The task force has requested that the Secretary and the Administrator of EPA each establish an agricultural air quality initiative for research on particulate, ozone and odors. The Chief, Natural Resources Conservation Service (NRCS) supports this initiative and has directed his agency to develop a non-research budget initiative which will provide increased levels of technical assistance toward implementation of measures to control emissions of particulate and odors, and to minimize the effects of ozone on crops.

Particulate matter of less than 10 micrometers in size penetrates human lungs and is said to cause a number of ailments of varying severity, including premature death in the elderly. Airborne pathogens, either as particulates or on particulates, are a serious concern particularly near animal operations. States are required to regulate particulate matter emissions and to develop implementation plans for areas that do not develop standards. Odors associated with agricultural animal production operations carry a nuisance classification at present, but evidence is being gathered to show that adverse health effects also occur. Also, elevated concentrations of tropospheric ozone, another air quality issue, can cause significant losses in the yields of some crops. Particulate matter compliance standards are expected to be imposed on farm operations in several parts of the Nation.

Outcomes

The proposed research will result in a greater understanding of the processes of dust and odor emissions and the technologies to control or mitigate them. Practices will be established for the purpose of protecting crops against ozone damage. The ultimate outcome is to make economical technologies available to farmers for use in becoming better neighbors while at the same time remaining competitive.

ARS research in these areas supports Performance Goal 4.1.1.1: demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base; Performance Goal 4.1.2.1: documentation of agriculture's effects on the global environment; Performance Goal 4.3.3.1: demonstrate technologies to store, mix, compost, inoculate, incubate, and apply wastes to obtain consistent economic benefits while at the same time minimizing environmental degradation, nutrient loss, and noxious odors; and Performance Goal 4.3.3.2: demonstrate the conversion of agricultural waste into liquid fuels and industrial feedstocks.

Specific Program Thrusts

- **Develop New Knowledge on Particulate Emissions and Controls** ($1,500,000).

Croplands research will be conducted in dust prone areas of the U.S., primarily the Great Plains, the Pacific Northwest, and San Joaquin Valley, and in areas where residue burning is widely practiced. Research will focus upon emissions that occur either as a result of agricultural operations or wind erosion. Research will also be conducted with feedlots and other animal operations, with attention given to pathogens and particulates. New knowledge will be sought regarding the factors that influence the occurrence of emissions and their downwind travel. The integration of this knowledge will result in control technologies and processes for evaluating various control alternatives.

- **Develop New Knowledge on Emission and Control of Odors** ($250,000).
  Animal manures will be the primary focus of this research. The goal will be to determine how odors are emitted and how they can be mitigated through management of feeds, waste storage and handling, and waste utilization or disposal. A high priority goal is to develop technology for measuring and assessing the presence, strength, and offensiveness of odors so that the impact of emission controls may be documented.

- **Conduct Research on the Protection of Agricultural Crops from the Effects of Tropospheric Ozone** ($250,000).
  Research will be conducted on the effects of tropospheric ozone on crop productivity to determine economic costs and benefits to agriculture of atmospheric ozone. The impact of ozone on plants and other agronomically important variables, such as elevated carbon dioxide, pests and pathogens will be researched. Plant genetic variability to ozone stress and mechanisms for resistance will also be investigated to provide the basis for developing ozone resistant crop cultivars.

d) <u>An increase of $15,300,000 for research in support of Global Change Research.</u>

Agriculture is vulnerable to changes in climate. Rising temperatures, changing amounts and patterns of precipitation, increased variability in weather, and increases in the frequency and intensity of extreme weather events like drought and floods are predicted to accompany the intensification of the greenhouse effect. Unless procedures and tools are developed to anticipate and adapt to such change, there could be negative impacts on crop and livestock production. These changes would make it more difficult to achieve a variety of USDA conservation and environmental goals.

However, changes in agricultural land uses and production practices that conserve natural resources appear to be reducing greenhouse gas emissions or removing them from the atmosphere and sequestering them in soils and vegetation as organic carbon. Such reductions in greenhouse gas concentrations mitigate climate change by slowing the rate of global warming. The rates of sequestration have not been quantified for many forage production and cropping systems, soil types, and regional environments, in a systematic and comprehensive manner, despite the importance of accurately predicting future levels of atmospheric greenhouse gases and consequent climate change. Uncertainty regarding sequestration of carbon in agricultural soils became a critical issue when U.S. negotiators were successful in efforts to have carbon storage recognized in the Kyoto protocol as a way to reduce greenhouse gas emissions. However, additional information is needed concerning reductions in atmospheric levels of greenhouse gases by utilizing management and conservation practices to store carbon in agricultural soils. Rates of agricultural carbon emissions and sequestration must be documented by direct measurement and extrapolation across a broad spectrum of land uses, land management practices, and resource conservation practices, as influenced by regional differences associated with soil properties, climatic conditions, and cropping systems. The long-term capacity of agricultural lands to sequester carbon can be established by comparison of carbon dynamics in different cropping systems that have been maintained at the same sites for decades. The potential for utilizing grazing management and vegetation restoration to enhance rates of carbon assimilation and storage in the soils of rangelands and pastures needs to be evaluated by monitoring carbon dynamics in large-scale manipulative experiments and using simulation models currently under development.

Increasing soil carbon content is a key component of the continued development of approaches to food production that are sustainable and environmentally benign, for reasons other than reduction of atmospheric levels of greenhouse gases. Soil carbon content is a principle indicator of soil quality. Enhanced carbon contents increase soil water holding capacity, soil fertility, and soil tilth. Consequently, identification of ways farmers and ranchers can raise soil carbon contents will contribute to sustainability, environmental quality, and efficiency of crop and livestock production, as well as forestalling climate change.

Additional research must also be devoted to understanding climate change effects and to identification of options for mitigating impacts on agriculture and food availability. Of special importance is the possibility of reductions in crop yields due to rising temperatures and changing amounts and patterns of precipitation. A changing climate also may alter competitive relationships between weeds and crops and the frequency of insect infestations, increasing the severity of weed infestations and challenging our ability to control pests. The greatest potential for mitigating the effects on agriculture of climate and other environmental changes is found in genetic diversity. It is necessary to experimentally identify the germplasm which is most tolerant to adverse effects and responsive to potentially positive influences, such as rising carbon dioxide levels.

Outcomes

The proposed research will provide scientific information and technology that serves as a basis for selection among alternative production practices and conservation practices and for optimizing on-farm flexibility of managers, thereby helping to mitigate potential global change effects. Accurate measurements of greenhouse gas emissions or rates of storage in soils by agricultural activities also will mitigate climate change and assist in prediction of future greenhouse gas concentrations, improve accuracy of climate change models, and support the formulation of sound climate change policies. Emissions and storage data will be extrapolated to the national scale using appropriate models. Potential participation of agriculture in carbon trading as a component of greenhouse gas reduction strategies will require verification of agriculture's role as a source and a sink for greenhouse gases. The proposed research also will provide additional knowledge of potential impacts of climate change on agriculture, especially the mechanisms of plant responses to rising temperatures and reductions in precipitation. The research will also provide options for adaptation to climate change impacts based upon utilization of genetic tolerance to stress.

The proposed research in these areas supports Performance Goal 2.1.3.3: release of improved germplasm, varieties, and breeds based on effective use of genetic resources; Performance Goal 4.1.2.1: documentation of agriculture's effects on the global environment; and Performance Goal 4.1.2.2: documentation of how changes in the global environment affect agriculture.

Specific Program Thrusts

- **U.S. Global Change Research Program, Carbon Cycle Research Initiative** ($5,000,000). ARS participates in the planning and other activities of the U.S. Global Change Research Program (USGCRP), and ARS representatives participated in the development of USGCRP Carbon Cycle Research Initiative. ARS will collaborate with other Federal agencies to develop needed information concerning the role of agriculture in the carbon balance, and especially to define ways which farmers and ranchers can store carbon in agricultural soils. Special emphasis will be given to measurements on the effects of management and conservation practices on carbon storage in cropland and grazingland soils, especially the long-term impacts of various tillage and residue management systems on accumulation of organic carbon. Basic research will define the mechanisms by which soil carbon is lost to the atmosphere or transferred to stable organic soil carbon pools. ARS also will cooperate with other Federal agencies and its university partners to document rates of emissions of greenhouse gases associated with crop, livestock, and forage production systems, and develop and evaluate

methods to reduce them, including rates of methane emissions from ruminant livestock and livestock waste lagoons.

- **Research on Mitigating Climate Change Impacts on Food Availability** ($2,000,000).
  ARS will expand research to define reductions in seed production of certain crops by elevated temperatures within the range of increases predicted by climate change models. Successful mitigation of this effect of climate change are dependent upon an understanding of the fundamental mechanisms by which temperature stress causes plants to shed immature fruit or fail to develop grain. To date, too little attention has been given to documenting and utilizing the genetic variation among plants within a species to tolerate adverse impacts of climate change or to respond in positive ways to the "fertilization effect" of rising atmospheric carbon dioxide levels. Additional research is also needed to test preliminary indications that competition between crops and weeds, which are mostly of tropical origin in the U.S., will intensify with global warming.

- **Research on Impacts of Atmospheric and Climate Change on Alaskan Agro-Ecosystems** ($1,000,000).
  Predictions indicating that climate change will be most strongly expressed at high latitudes have been underscored by recent evidence of warming in Alaska. Preliminary evidence suggests that the Alaskan climate is improving for crop production. Unique responses of northern ecosystems to climate change, the direct effects of rising atmospheric carbon dioxide on plant growth, and interactions of these effects are of special scientific interest in Alaska because of the unusual light regime and other abiotic characteristics of Alaskan ecosystems. Experimental hypothesis testing under both controlled and field conditions is required to document the significance of potentially positive responses of Alaskan agriculture and natural ecosystems to climate. Special attention will be given to current climatic limitations to productivity of crops and forages; interactions between warming, rising carbon dioxide levels, and availability of water, nutrients, and light energy; and other aspects that affect the potential of Alaskan interior and coastal regions for increased crop, forage, and livestock production.

- **U.S. Global Change Research Program National Assessment Activities** ($300,000).
  Assessments and their related research play an integrative role across the USGCRP program areas. Assessments assemble and synthesize scientific results, help increase interaction among scientists and the public, and help identify gaps in knowledge. Assessments are increasingly viewed as important vehicles for disseminating information to public policy and decision making communities. The current National Assessment of the Consequences of Climate Variability and Change for the Nation marks a milestone in the evolution of the Global Change Research Program (USGCRP). First, the addition of assessment activities to the research program satisfies the mandate of the Global Change Research Act of 1990 (P.L. 101-606) to prepare and submit to the President and the Congress "an assessment which integrates, evaluates, and interprets the findings of the Program..." Second, the assessment is demonstrating a new public-private partnership that links research to the needs of stakeholders by providing managers, policy-makers, and the public with information needed to increase resilience to climate variability and cope with climate change.

  The current National Assessment is providing valuable information on the regional and sectoral differences in adapting to climate change and variability and is identifying research needs. FY 2000 assessment activities would focus on completing the first National Assessment and on continued efforts to involve USDA stakeholders in helping identify risks, opportunities, research and information needs associated with increased climate variability and climate change.

- **New Technology for Predicting and Adapting to Global Change Impacts** ($7,000,000)
  The research focuses on development of new knowledge and modeling technology which will reduce agriculture's vulnerability to a changing environment. Existing gaps in our ability to predict global impacts with accurate simulation models will be closed, and mid- to long-term data bases required for

model calibration and validation will be developed. Field experiments will be established to generate response functions for important climate change impacts which have not been previously explored, such as effects of changing amounts and patterns of rainfall on forage and biomass production. Fundamental questions concerning physiological and molecular responses to climate change will also be addressed in ways that will provide new avenues for developing crop germplasm which is tolerant of elevated temperatures, limited soil water, and other implications of a changing climate. In addition, the research will enhance our capability to predict effects of global change on the management and conservation of natural resources. An aspect of management that will be explored is improving agricultural biomass to enhance carbon sequestration through build-up of soil organic matter. ARS will collaborate with other Federal agencies to develop needed information concerning the role of agriculture in the carbon balance, and especially to define ways by which farmers and ranchers can store carbon in agricultural soils. Special emphasis will be given to measurements on the effects of management and conservation practices on carbon storage in cropland and grazingland soils, especially the long-term impacts of various tillage and residue management systems on accumulation of organic carbon. New knowledge of the effects of soil and crop management and conservation practices on soil carbon storage will guide climate change mitigation policy and assist in the development of strategies and technologies to mitigate greenhouse emissions.

e) A decrease of $1,973,000 in ongoing Soil, Water, and Air Sciences research to provide savings to finance higher priority research initiatives.

ARS is recommending the termination of selected research projects within the Soil, Water, and Air Sciences research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There are 5 specific research projects recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Soil, Water, and Air Sciences research projects.

- -- Shallow Groundwater Management Systems for Arid Irrigated Areas
- -- Impact of Agricultural Management Practices on Soil and Water Quality at the Field and Watershed
- -- Development and Evaluation of New Remote Sensing Technologies to Assess Food and Fiber Production
- -- Farming Systems to Improve Soil and Water Quality
- -- Biology and Management of Soilborne Diseases and Beneficial Soil and Root-Inhabiting Microorganisms
- -- General Reduction

OBJECTIVE 2: PLANT SCIENCES

2) A net decrease of $24,584,000 for Plant Sciences consisting of:

a) An increase of $3,982,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $4,033,000 for research on **Emerging and Exotic Diseases, and Pests of Crops.**

Exotic and emerging insects, diseases, and weeds are severe problems throughout the U.S. Increases of these harmful organisms may be attributed to the introduction of these organisms into new geographic regions; modifications to the environment that favors diseases, pests or weeds; changes in crop management practices; genetic shifts in pest populations; and other processes that may give them a competitive advantage. Accurate taxonomic identification and classification of these insects, pathogens, and weeds is essential for providing effective control.

Emerging weed, insect and disease species that threaten natural and managed ecosystems continue to be discovered in the U.S. For example, giant salvinia, a major aquatic weed in Australia, Papua New Guinea, and several African countries, was found established in the southwest U.S. this year. Other weed species of importance include several nightshades, Cape ivy, several thistles, several mustards, Old World climbing fern, saltcedar, snakeweeds, knapweeds, whitetop, medusehead, perennial pepperweed, and many others. Priority emerging insect pests include species such as Asian longhorned beetle, and potential pests such as the pink hybiscus mealybug. Programs are being developed in close consultation with customers, incorporating their priority rating for weed species.

Research and development of new pest control technologies, particularly biologically-based technologies such as host-plant resistance, biological control, semiochemical treatment methodologies (e.g., pheromone mating disruption), and other technologies must be expanded. Additionally, pest sampling and detection methods need to be improved, pesticide application technologies need to be made more efficient, and new precision agricultural technology needs to be evaluated for efficiency.

Research on integration of different control technologies into effective, economical, and sustainable Integrated Pest Management (IPM) systems should be conducted so that practical integrated solutions to these problems can be transferred to agricultural producers, land managers, and other pest control personnel.

Outcomes

The proposed research on emerging and exotic diseases, insects, and weeds will benefit society by maintaining and improving the ability of U.S. farmers to provide healthful food. Preventing the introduction of exotic pests and controlling existing ones will help ensure the U.S. of a plentiful food supply and open export markets.

ARS research in these areas supports Performance Goal 1.1.2.1: demonstrate techniques to control or eliminate postharvest insects and diseases, and increase market quality and product longevity; Performance Goal 2.1.2.1: demonstrate new integrated technologies to protect plants, animals, and ecosystems; Performance Goal 2.1.3.1: collections of well-documented germplasm of importance to U.S. agricultural security are readily available to scientists and breeders for research and development; Performance Goal 2.1.3.4: improve methods for identifying useful properties of plants, animals, and other organisms, and for manipulating the genes associated with these properties; Performance Goal 2.2.1.1: transfer knowledge developed by ARS to industry and regulatory agencies; and Performance Goal 4.3.1.1: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment.

Specific Program Thrusts

- **Rapidly Identify, Prevent, and Control Emerging and Exotic Plant Diseases including Fusarium Head Blight** ($1,500,000).

  Disease control depends on accurate and timely identification of the pathogens involved. More sensitive and accurate methods of pathogen detection and identification are needed for domestic production as well as for imported and exported commodities. Improved methods of biological control are needed to replace or supplement the use of synthetic pesticides. Additional research to improve the efficacy of potential biocontrol agents through genetic selection and bioengineering is required.

Enhancing plant resistance depends on characterizing genes for resistance and incorporating them through conventional breeding or genetic engineering. The proposed research will enhance the ability to control diseases through host plant resistance.

- **Control Emerging and Exotic Weeds and Plant Pests** ($2,033,000).
Each year, several exotic insect and weed pests invade North America causing new threats to the security of crop and commodity production systems. Identification of these threats and rapid response to their control is of major importance. While protecting agricultural production systems from these pests, it is also extremely important that the natural environment be safeguarded from any unwanted side effects. Many pest control tactics have the potential to affect nontarget insects and plants that are important. ARS has implemented fundamental changes to how weed biological control programs are planned and conducted. In particular, we now require a post-release monitoring plan that includes identification, marking in the field and monitoring of potential nontarget species, and incorporation of cultural control/revegetation as appropriate. This research is designed to provide new information on pest biology, impact, and control technologies to further improve their safety and effectiveness while providing increased protection of the natural environment. The technologies developed will provide the basic pest control components used to develop effective and sustainable IPM programs that support crop production systems and ecosystems.

- **Systematics of Invasive Weeds and Other Pests** ($500,000).
ARS will conduct systematic studies of key pest groups in support of the Nation's integrated pest management efforts and in support of action agencies. The U.S. is invaded by dozens of new pest species each year. Many of these will become established pests of agriculture and the environment. The proposed systematics research will provide an increased ability to rapidly identify invading pest species supporting the ability of action agencies, which rely on ARS identifications, to eradicate or exclude the invading species. Systematics is also the keystone for developing biologically-based integrated pest management programs. This research also has important implications for conservation biology and biological diversity studies by enhancing the ability to identify key species.

c) An increase of $1,000,000 for research in support of **Agricultural Plant Genomes**.

The U.S. agricultural system faces formidable challenges. Climatic extremes, water and soil pollution and degradation, and environmental regulations may rapidly complicate agricultural production and processing resulting in more rapidly increasing prices, more volatile commercial markets, reduced profits for producers, and a narrower competitive edge for U.S. products in world markets. More costly food may result in less nutritious diets for the poor.

Human populations occupy an ever greater proportion of formerly productive agricultural land. As a result, productivity can be raised only by increasing the yields of the remaining land under cultivation. New, more intensive production practices may increase yields but place new demands on crops, and beneficial insects. New pests and pathogens or more virulent genetic variants of the latter are cause for grave concern.

Value-added and alternative crops are needed to increase the monetary returns of producers (especially in rural areas), and to diversify the productive capacity of the U.S. agricultural system to insure national food security. Extinction of genetic resources, or their inaccessibility, may increase the genetic vulnerability of agriculture.

The challenges can only be met by optimally harnessing the inherent potential of genetic resources. More rapid and efficient methods are required to identify and manipulate useful properties of genes and genomes. These new methods, collectively termed "genomics," rely on more detailed, accurate, and comprehensive knowledge of genomic organization in order to effectively characterize genes and

elucidate their function. Genomics and biotechnology are critical for developing improved crops, and beneficial insects for enabling producers to maximize yields of high quality products, while minimizing environmental degradation and production costs.

Outcomes

The proposed research will provide the means for maintaining and enhancing the quality and safety of the U.S. supply of food, fiber, feed, medicines, biofuels, industrial products, and ornamentals. It will also strengthen the U.S. agricultural competitiveness in global markets by ensuring continued genetic improvement of crops, assuring a plentiful supply of bees and other insect pollinators, and shielding crops from genetic vulnerability caused by an inadequate supply of genetic diversity.

ARS research in these areas supports Performance Goal 1.1.2.1: demonstrate techniques to control or eliminate postharvest insects and diseases, and increase market quality and product longevity; Performance Goal 1.1.3.1: demonstrate postharvest technologies that add value and improve quality; Performance Goal 1.2.2.1: experimentally demonstrate improvements in processing technologies and develop new bioproducts and uses that have potential to increase demand for agricultural commodities; Performance Goal 2.1.3.3: release of improved germplasm, varieties, and breeds based on effective use of genetic resources; and Performance Goal 2.1.3.4: improve methods for identifying useful properties of plants, animals, and other organisms, and for manipulating the genes associated with these properties.

- **Develop Bioinformatic Tools, Biological Databases, and Information Management Technology** ($600,000).
  The proposed research will advance and refine genomic and biological database technology so that database managers, researchers, computer programmers, and genetic resource managers can more effectively and efficiently generate, store, locate, arrange, interrelate, analyze, and communicate the voluminous data issuing from gene sequencing, genomic mapping, and other genomic research. Plant scientists and entomologists will be trained or retrained to apply this technology to their research and/or genetic resource management programs. As a result, these tools will enhance the productivity and value of crop improvement, crop and insect (especially bee) genetics, and genetic resource management.

- **Apply Functional Genomic Approaches to Manipulating the Function of Important Genes for Crops** ($400,000).
  The proposed research will link the congruence of patterns in gene expression with patterns of enzyme quantity and quality in grains.

d) An increase of $3,167,000 for research to address impact of **FQPA Implementation**.

The provisions of the Food Quality Protection Act of 1996 (FQPA) require EPA to reassess all pesticide tolerances within ten years of passage of the Act (the riskiest one-third of currently used pesticides within the first three years) and to change its standard for evaluating pesticides from an acceptable risk/benefit profile to a reasonable certainty of no harm. During the first phase of tolerance reassessment now underway, EPA is reviewing the tolerances of organophosphate, carbamate and B-1/B-2 carcinogen pesticides. This is likely to affect the permissible uses in agriculture of many pesticides. The new standard of safety will require more precise information on current use patterns, routes of exposure to pesticides, and alternative pest control technologies collected by the National Agricultural Pesticide Impact Assessment Program and other REE programs.

USDA policy already places high priority on funding, development and testing of safe substitute technology for currently used pesticides at risk of being phased out after review by EPA. The Department is committed to implementation of IPM practices on 75 percent of the Nation's crop

acreage by the year 2000. The Department also supports efforts to develop areawide pest management programs using biointensive IPM approaches, minor use pesticide programs, biological control agents, and other IPM components technology that can be used to control pests as alternatives to chemical pesticides that are at risk of being prohibited by FQPA implementation.

Outcomes

The proposed research will develop and/or demonstrate in IPM field approaches, new technology and new management practices to substitute for the use of "hard" pesticides, such as organophosphate and carbamate insecticides, and will provide new, target-specific biointensive approaches to control crop and other agricultural pests. The results of the program will be increased alternative pest management technologies that are demonstrated to be cost-effective, efficacious, environmentally compatible and sustainable over the long term. At the same time, the proposed research will contribute to the interdepartmental (USDA, EPA, and FDA) commitment to implement IPM programs on 75 percent of the U. S. crop acreage by the year 2000. The research will also help provide minor-use chemicals and biorationals that can substitute for chemical pesticides at risk.

ARS research in these areas support Performance Goal 4.1.1.1: demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base; Performance Goal 4.1.2.1: demonstrate cropland and grazinglands; Performance Goal 4.2.1.1: risk-reduction strategies and methods transferred to the Nation's agricultural industry; Performance Goal 4.3.2.2: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment; and performance Goal 4.3.2.1: demonstrate the effectiveness of integrated agricultural producing systems in the improvement of natural resources and protection of the environment.

Specific ProgramThrusts

- **Expand Areawide IPM Programs Demonstrating Alternatives to At-Risk Pesticides** ($1,000,000). New projects selected for implementation will be chosen through a stakeholder and scientific review process with major criteria tied to IPM replacement technology for at-risk pesticides used on crops of dietary importance to infants and children (organophosphates and carbamates) as a result of the FQPA. Other criteria will consider scientific validity, likelihood of success, and importance of the pest. Because pests are mobile and can enter or leave a test site composed of a single field, potential IPM replacement technologies for at-risk pesticides as a result of FQPA must be evaluated in a large area (ecosystem) setting. A carefully coordinated effort is required, involving Federal research and extension agencies, and cooperating State institutions.

- **Support for the USDA Office of Pest Management and Policy** ($1,500,000).
ARS provides technical and administrative support to the USDA Office of Pest Management and Policy (OPMP).

  The Department has established a new Office of Pest Management Policy (OPMP) to coordinate USDA's response to FQPA issues. This office will work closely with EPA to ensure that FQPA implementation decisions are based on sound science, transparency, consultation with the public, and a reasonable implementation transition period for agriculture. Funding is included in the President's Fiscal Year 2000 Budget to continue OPMP, and an additional $1.5 million is requested to strengthen its activities.

  OPMP is responsible for insuring USDA compliance with the demands of the FQPA. The Office is also responsible for the coordination and integration of USDA pest management data and related programs, including biotechnology. OPMP provides a single contact point for EPA pesticide program managers and represents the Secretary of Agriculture on pesticide regulatory matters pending in EPA. OPMP works closely with USDA's land-grant partners to maintain and utilize the network of crop

and pest management experts in the pesticide decision-making process. OPMP assembles and makes available data on crop and pest management practices, alternatives control options, and the establishment of transition strategies that may be required by implementation of the FQPA. Additional funding is required to adequately staff the office and to develop transition strategies for crops used in food products that are most frequently consumed by children.

- **Develop IPM Component Technology for Fruits and Vegetables Treated with Organophosphates and Carbamates, and for Pests Under Large-Scale Action Agency Eradication or Control Programs** ($667,000).
  ARS plans to expand its IPM component technology research on the use of biologically-based IPM strategies to specifically help U.S. agriculture adjust to changes resulting from implementation of the FQPA. ARS and its partners have an important role to play in providing affected pesticide users with the knowledge, technology, and support needed to make the transition to new alternative pest management strategies. Alternative pest management approaches must be developed to replace pesticides such as the organophosphates and carbamates removed from the marketplace as a result of regulatory actions. Although some IPM methods are ready for implementation, the knowledge base is lacking to deal with many pest problems in an integrated fashion. The knowledge and technologies developed by expanded research efforts will form the building blocks of comprehensive IPM systems. This research will focus on development of: improved semiochemical techniques for control of insect pests on fruits and vegetables; ecologically sound IPM technology for management of insect pests in apples in the Eastern U.S.; biological control and biorational techniques for nursery and horticultural pests; IPM technologies to replace malathion for boll weevil control and eradication; biorational techniques to replace malathion for management and eradication of fruit flies; and biologically-based control technologies for fireants.

e) An increase of $3,300,000 for research in support of Sustainable Ecosystems.

Resource managers, public officials, business leaders, and concerned citizens throughout the Nation are working toward new approaches to manage regional growth and ensure the viability of the ecosystems. Central to the success of these new consensus-based adaptive strategies is the ability to understand, monitor, and model ecosystems. Taken together, these will enable managers to assess and predict the outcomes of various decision scenarios. As a result, science and technology are increasingly depended upon to evaluate the current state of ecosystem structure and function, assess the impacts of stressors on ecosystem goods and services, and identify management approaches that prevent further adverse impacts, conserve critical habitats, and restore damaged systems to a viable state. There is a demand for reliable information that integrates biological, chemical, and physical sciences with social and economic analyses to devise strategies and technologies for conservation and restoration of the ecosystems. ARS is increasing research effort on weed species that threaten ecosystems.

Outcomes

The proposed research is designed to significantly improve the understanding of ecosystems and the ability to manage them. ARS' participation in the initiative will ensure an effective multidisciplinary approach to ecosystem sustainability and a practicable link to transfer new science and technology to action agencies.

ARS research in these areas supports Performance Goal 2.1.2.1: demonstrate new integrated technologies to protect plants, animals and ecosystems; Performance Goal 4.1.1.1: demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base; Performance Goal 4.1.3.1: demonstrate cropland and grazingland management strategies that improve productivity and efficiency of croplands and grazinglands; Performance Goal 4.2.1.1: risk-reduction strategies and methods transferred to the

Nation's agricultural industry; Performance Goal 4.3.1.1: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment; and Performance Goal 4.3.2.1: demonstrate the effectiveness of integrated agricultural producing systems in the improvement of natural resources and protection of the environment.

Specific Program Thrust

- **Prevent and Control Invasive Weed Species for Ecosystem Management** ($600,000).
  The proposed research is focused to address a key component of total ecosystem management, namely, prevention and control of invasive weed species such as melaluca, leafy spurge, salt cedar and yellow starthistle. ARS will develop technology and information to improve early detection and monitoring of these weed species into ecosystems; implement integrated weed management strategies using biological, cultural, and chemical controls; and develop habitat restoration procedures that will establish and maintain desired vegetation.

- **Develop and Implement Biologically-Based Integrated Pest Management Systems for Invasive Weeds** ($2,700,000).
  Invasive weed species such as melaluca, leafy spurge, salt cedar, and yellow starthistle spread widely with little to limit their negative impacts on total ecosystem management because they have entered the country without their co-evolved natural enemies. Foreign exploration and host-specificity testing will be initiated to determine the key safe natural enemies for the invading species. The natural enemies will be imported through USDA-approved quarantine facilities and, after approval by regulatory agencies, released into the environment. ARS will then develop biologically-based pest management systems for the invaders, in close collaboration with Federal, State and local partners.

f) A decrease of $12,566,000 in ongoing Plant Sciences research to provide savings to finance higher priority research initiatives.

ARS is recommending the termination of selected research projects within the Plant Sciences research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There are 52 specific research projects recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Plant Sciences research projects.

- -- Rice Genetics Research
- -- Enhancing Rice Grain Quality
- -- Technology to Enhance Soybean Oil for Food and Non-Food Uses
- -- Enhanced Production of High-Value Carotenoids in Tomato
- -- Ecologically Based Management of Salt Cedar (Tamarix) in the Western U.S.
- -- Biological Control of Yellow Starthistle and Other Non-indigenous Plant Pests in the Western USA
- -- Defining the Molecular Mechanisms of Heavy Metal Chilation and Sequestration in Plants
- -- Floriculture
- -- Behavioral Ecology and Management of Crop Insect Pests with Semiochemicals
- -- Development and Use of Molecular Techniques in Oat Enhancement
- -- Barley and Oat Germplasm Enhancement and Small Grains Germplasm Evaluation and Maintenance
- -- Reduced Herbicide Inputs for Effective Weed Management Systems to Improve Water Quality
- -- Sensors and Systems for Site-Specific Crop Management to Improve Environmental Quality

-- Soybean Diseases
-- Genetic Characterization of Soybean Germplasm
-- Quantitative Genetic Analysis and Improvement of Corn Populations
-- Genetics of Host Resistance to Pathogens in Cereal Crops
-- Ecologically-Based Pest Management of Selected Insect Pests of Corn
-- Genetic Enhancement of Hard Red Winter Wheat for Resistance to Multiple Biotic Stress
-- Improving Sugarcane Productivity by Conventional and Molecular Approaches to Genetic Development
-- Disease and Insect Control Mechanisms for the Enhancement of Sugarcane Germplasm Resistance
-- Developing Integrated Weed Management Systems for Efficient and Sustainable Sugarcane Production
-- Enhancement of Strawberry, Blueberry, and Other Small Fruit Crops Through Molecular Approaches and Breeding
-- National Turfgrass Evaluation Program
-- Germplasm Evaluation and Genetic Improvement of Oats and Wild Rice
-- Breeding and Germplasm Improvement
-- Biochemistry and Molecular Biology of Natural Products for Pest Control and Alternative Crops
-- Small Fruit Cultural and Genetic Research in the Mid-South
-- Genetic-Physiological Parameters that Enhance Fiber Quality
-- Agronomic and Economic Evaluation of Kenaf as a Field Crop in Mississippi
-- Plant Genetics Research
-- Biology and Control of Virus Diseases of Sorghum
-- Exploration and Maintenance of Fungi and Plants for Biorational Control of Agricultural Pests
-- Control of Fungal Pathogens of Small Grains
-- Evaluation of Temperate Legumes and Warm-Season Grass Mixtures in Sustainable Production Systems
-- Development of Soybean Germplasm and Production Systems for High Yield and Drought Prone Environments
-- Improving Resistance of Peanut to Biological Stress Through Germplasm and Cultural Enhancement
-- Characterization of Induced Cytokinin Changes in Wheat
-- Partitioning of Photosynthate as Influenced by Genotype, Mycorrhizae and Air Enriched with CO_2
-- Residue Management and Grass Seed Cropping Systems for Sustainable Agriculture
-- Specific Cooperative Agreements on Horticultural Crops
-- Hops Genetics and Breeding for Improved Flavor, Agronomic Performance and Pest Resistance
-- Preservation of Clonal Genetic Resources of Temperate Fruit, Nut, and Speciality Crops
-- Rice Germplasm and Variety Improvement in the Southern United States
-- Parasite Mite Control in Honey Bee Colonies Utilized in Honey Production and Crop Pollination
-- Genetically Enhanced Wheat for Quality Productivity and Resistance to Biotic and Abiotic Stresses
-- Biochemical and Molecular Regulation of Preharvest Sprouting and Grain Dormancy in Wheat
-- Control of Rusts and Smuts of Wheat and Barley
-- Arctic Plant Germplasm Introduction and Research
-- Genetics and Germplasm Enhancement of Cool Season Food Legumes
-- The Role of Life Strategies of Phytopathogenic Bacteria in the Epidemiology of Foliar Diseases
-- Agroforestry Systems for the Appalachian Region
-- General Reduction

g) A decrease of $27,500,000 for **Narcotics Research.**

Funds appropriated in FY 1999 under the Emergency Supplemental Appropriations for Counter Drug Research and Development in the amount of $23 million and a transfer from the Office of National Drug Control Policy (ONDCP) for Anti-Drug Research and Related Matters in the amount of $4.5 million are not included in the ARS budget for FY 2000. However, the Administration supports appropriations language currently being considered by the Congress which will make the $23 million provided under the FY 1999 emergency supplemental available until expended.

OBJECTIVE 3: ANIMAL SCIENCES

3) A net increase of $3,487,000 for Animal Sciences consisting of:

a) An increase of $1,867,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $4,100,000 for research on **Emerging and Exotic Diseases, and Pests**.

During the past few years emerging and reemerging infectious diseases and pests have become major public health and animal health concerns. Scores of new animal diseases have been recognized in recent years and the reemergence of highly infectious diseases of livestock, poultry and fish have caused many recent epidemics throughout the world. The globalization of trade, increased international travel, climate change, intensive agriculture, changing agricultural demographics, and practices and product processing are creating new opportunities for the reemergence and spread of infectious diseases and pests. Wildlife species are reservoirs of disease for domestic animals. Control of diseases depends on control in both domestic and wild animals.

The introductions of exotic animal species provides an avenue for introduction of new diseases or pests not present in the U.S. Exotic (non-native) pathogens or pests once introduced into the U.S. can explode into an epidemic due to the absence of natural control agents, lack of resistance by host animals, and limited knowledge to manage the spread of pathogens. Timely and effective control strategies are needed to avoid economic disruptions and lack of consumer confidence, such as that caused by bovine spongiform encephalopathy in the United Kingdom and Europe, swine fever in Europe, and foot-and-mouth disease in Taiwan. These diseases have caused billions of dollars of economic losses and resulted in trade embargoes, quarantines, and the destruction of livestock herds and cultivated fish stocks.

Research on diseases is an essential component of national emergency response systems needed to detect new pathogens as they emerge into new disease threats. For emerging diseases and pests to be effectively detected and controlled, the biology of the causal pathogens, pests, and parasites must be understood and strategies developed to limit their establishment and spread.

Outcomes

The proposed research will expand the understanding of disease and pest biology, and the impact on agricultural production systems. New and improved technologies and approaches and environmentally-safe and sustainable practices to manage or exclude disease and pest populations will be developed. Research on exotic and emerging pathogens and pests will lead to better diagnostic tests and improved methods to lessen production losses through the use of improved genetic resistance, biological control, safe and effective vaccines and drugs, and novel management systems based on pathogen weaknesses. These approaches to disease and pest control are expected to enhance food, fiber, and product quality; increase consumer and worker safety; and promote environmental stewardship, while minimizing producer risks and costs of disease and pest control. The proposed research will benefit society by

maintaining and improving the ability of farmers to provide consumers with the least expensive and safest food supply in the world.

ARS research in these areas supports Performance Goal 1.1.2.3: new and improved diagnostic tests are developed and available; Performance Goal 2.1.2.1: demonstrate new integrated technologies to protect plants, animals and ecosystems; Performance Goal 2.1.3.3: release of improved germplasm, varieties, and breeds based on effective use of genetic resources; Performance Goal 4.2.1.1: risk-reduction strategies and methods transferred to the Nation's agricultural industry; and Performance Goal 4.3.1.1: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment.

Specific Program Thrusts

- **Rapidly Identify, Prevent, and Control Emerging Exotic Infectious Diseases of Livestock** ($1,300,000).
  Diagnostic tests, novel vaccines including genetic vaccines, and immune modulatory strategies will be developed to prevent outbreaks and the spread of exotic animal diseases, such as classical swine fever. Protecting the U.S. livestock industry from these exotic pathogens will ensure competitiveness of U.S. animals and animal products in the global marketplace. A new generation of sensitive biochemical and molecular diagnostic methods will be developed for accurately identifying and monitoring the species, strain, biotype/genotype and serotype of exotic pathogens that are likely to threaten U.S. animals. Investigations of pathogen host interactions and genome mapping of the exotic pathogens will help in the development of new DNA-based pathogen detection technologies. Vaccines will be developed and tested to protect American agriculture.

- **Rapidly Identify, Prevent, and Control Emerging Domestic Infectious and Zoonotic Diseases of Livestock and Aquaculture** ($900,000).
  Expanded research is needed for accelerating the development of information and technologies for protection of U.S. livestock, poultry, and human health against emerging diseases such as avian leukosis. Additional research is also needed for developing: diagnostic tests and fundamental information for chronic wasting disease of cervids and other pathies. Research is needed for diseases such as coccidiosis in which drug resistance is emerging.

- **Develop Vaccines for Brucellosis in Wildlife** ($1,000,000).
  Research is needed to develop vaccines for wildlife to control diseases such as brucellosis. Wildlife movement is difficult to control. Domestic animals are exposed to disease from wildlife. Vaccines for wildlife require novel approaches, such as baits, to introduce the vaccine.

- **Control Livestock Pests** ($900,000).
  The proposed increase will produce new and improved methods for monitoring and control of pest flies of livestock. Research will focus on stable flies and improved traps baited with powerful species-specific attractants. Biologically-based IPM strategies will be developed to control pests. This research program will result in improved pest control technologies and more highly integrated pest control tactics and practices, including their applications on an areawide basis.

c) An increase of $800,000 for research in support of **Agricultural Animal Genomes**.

Note: See Agricultural Genomes under Plant Sciences.

The continuous increase in costs to operate animal production units requires producers to improve the efficiency of production, and the quality and safety of food products from animals. Research on animal genomes (gene maps and their associated DNA markers) will provide information on the genotype of animal. This will improve the accuracy of genetic selection; identify and move new genes

into livestock populations; characterize the most valuable animal germplasm populations; and identify the genes responsible for disease and parasite resistance in animals.

Outcomes

The proposed research will provide the means for maintaining and enhancing the quality and safety of U.S. animal-based food, fiber, feed, and industrial products. It will also strengthen the U.S. agricultural competitiveness in global markets by ensuring the continued genetic improvement of animals (including fish), and shielding agricultural animals from genetic vulnerability caused by an inadequate supply of genetic diversity.

ARS research in these areas supports Performance Goal 2.1.3.2: documented DNA base sequences of agricultural importance; Performance Goal 2.1.3.3: release of improved germplasm, varieties, and breeds based on effective use of genetic resources; and Performance Goal 2.1.3.4: improve methods for identifying useful properties of plants, animals, and other organisms, and for manipulating the genes associated with these properties.

- **Combine New Genomic Approaches for Improving Economically Important Traits in Livestock that Affect Animal Health and Economic Yield** ($300,000).
  The proposed research will combine new genomic tools and approaches with population genetics methods to discover, characterize, and manipulate genes that confer agricultural animals with improved genetic resistance to disease. The value of the following technologies for animal genetic improvement will be assessed: single nucleotide polymorphisms in conjunction with microchip assays and DNA microarrays for identifying genes involved in QTL expression. By combining conventional and novel genomic-based breeding methods, researchers can effectively manipulate these newly identified genetic sources to improve animals.

- **Develop Bioinformatic Tools, Biological Databases, and Information Management Technology** ($500,000).
  The proposed research will advance and refine genomic and biological database technology so that database managers, researchers, computer programmers, and genetic resource managers can more effectively and efficiently generate, store, locate, arrange, interrelate, analyze, and communicate the voluminous data issuing from animal gene sequencing, genomic mapping, and other genomic research. As animal SNPs (single nucleotide polymorphisms) and ESTs (expressed sequence tagged sites) are characterized, these new data must be added to and readily retrievable from genome databases for genetic analyses. Current animal genome databases must be expanded to meet these needs and/or human and bioinformatics resources must be adapted to animal genome requirements. For species where relational databases on reference populations have not been established, resources must be identified and allocated to appropriate research locations, along with sufficient support personnel. Analyses of extensive data sets, detailed animal pedigrees, and multigenic control of QTLs require highly sophisticated statistical computer programs, novel analytical approaches, and scientists with unique modeling skills and access to sophisticated computing capacity. Animal scientists will be trained to extend these new technologies and approaches to their research programs. As a result, these tools may tangibly enhance the productivity and impact of animal genetics, breeding, and genetic resource management.

d) An increase of $7,300,000 for research in support of **Preharvest Food Safety**.

The Food Safety Initiative, and the REE and ARS Strategic Plan goals of a Safe and Secure Food and Fiber System recognize that food safety is a farm-to-table continuum involving both plants and animals and that food safety problems must first be addressed in the production environment. Exposure and infection of animals by zoonotic pathogens during production, which is accentuated by the increasing

animal density of present day livestock operations, is a major source of contamination in meat-based foods and farm produced seafood. These pathogens may also contaminate fruits and vegetables.

Effective handling systems for animal manures will help break the cycle of enteric infections with human pathogens in food producing animals. They will also help assure that pathogens from animal manures do not contaminate drinking and food processing waters, or contaminate fruits and vegetables. Systems are needed to assure effective inactivation including identification of sources and reservoirs on the farm and in the environment; development of pathogen reduction processes suitable to farm size and manure production levels; and reduction of farm level transport, dissemination, and vectoring of pathogens. Fruit and vegetable safety can be enhanced by the development of plant varieties and strains that are resistant to infection with rots and molds that provide a media for human pathogen growth. The resistance of pathogens to antibiotics, particularly the DT104 pattern of resistance in salmonella to multiple antibiotics has been increasingly recognized by the public health and medical communities. Antibiotic use in animals is identified as a contributing factor. ARS must expand preharvest food safety research to address these critical research needs.

Outcomes

The proposed research will result in fewer pathogens in the production environment, for food producing animals and fruits and vegetables. Animals presented for slaughter will have fewer pathogens as will food products from them which will increase food safety. There will also be fewer pathogens contaminating fruits and vegetables. Prevention of illnesses and deaths will bring substantial benefits to society, and disruptions in normal, healthy eating patterns resulting from food safety scares will be prevented. Enhanced consumer confidence in both plant and animal food products will substantially benefit producers.

ARS research in these areas supports the objective of maintaining a safe food supply through Performance Goal 2.2.1.1: transfer knowledge developed by ARS to industry and regulatory agencies.

Specific Program Thrusts

- **Develop Pathogen Destruction Processes for Animal Waste** ($2,500,000).
  The research will develop practical and economical pathogen reduction processes for manure from food producing animals. Different processes will be developed for each major type of animal production facility; the processes will be scaled to farm size and manure production levels with well defined process parameters. These methods to handle and treat poultry, swine and cattle manure during production will prevent transmission of pathogens to agricultural lands and crops used for human food. It also will prevent their possible distribution to crops or other animals from surface runoff and irrigation waters. Where appropriate the research will include investigation of wild animals and other vectors as potential sources of pathogen animal wastes. The development of active and passive manure treatments or composting techniques will reduce or eliminate pathogens in manure, and prevent their transmission to food products.

- **Research Antibiotic Resistance** ($1,800,000).
  The research will determine the concentration, length of time antibiotics will be used, and other selective factors or conditions favoring the acquisition and dissemination of resistance genes among pathogens and nonpathogens in food producing animals. Basic information, using chemostat model systems, on time, and dose dependency of various antibiotics which favor the emergence of resistant organisms in the gastrointestinal tract of food animals species will be developed. Where necessary, research will develop molecular characterization methods to facilitate the identification of the resistant pathogens detected in food and tracing them back to the source (e.g., environment, manure, water, animal feed). This information will be developed for poultry, cattle and swine. The research will also seek to determine if the increases of morbidity and mortality sometimes associated with antibiotic resistant organisms are due to genetic factors for increased virulence which accompany the bacterial

resistance genes. As necessary, prospective ecological studies that better define sources of resistant bacteria in the environment will be conducted. New technologies including competitive exclusion and immunotherapy will be developed to reduce antibiotic use in the production of meat animals.

- **Develop Predictive Models for Risk Assessment** ($2,400,000).
Risk assessment is necessary to evaluate the effects of production practices, processing, and transportation systems on the contamination of food producing animals, that is, cattle, swine and poultry, as they are presented for slaughter. Quantitative microbiological data is needed to carry out the mathematical computations and to develop and validate predictive microbiology models which are necessary components of risk assessments. The proposed research will gather data on the incidence and number of pathogens on food producing animals at various critical stages of production and management systems. This data will be used to develop predictive models for the risk of transmission of zoonotic pathogens through farm management systems to the presentation of animals for slaughter. In addition to production practices, microbiological and animal behavioral data will be generated and evaluated on various systems used for transporting swine in relation to subsequent contamination of the animals at slaughter. The research will also develop predictive models for the risk of transmitting zoonotic parasites through farm management systems, animal manure, and water runoff.

- **Reduce Fungal Toxins from Endophytic Fungi in Corn and Grasses** ($300,000).
Fungi that infect corn and grasses produce chemicals that are toxins to humans and animals. Research is needed to prevent the infection of corn and grasses by toxin producing fungal species. Research is needed to discover and produce non-toxic infectious species that can replace toxin producing fungi and to develop methods for their application.

- **Reduce Zoonotic Disease Risk** ($300,000).
Food safety risk in poultry may depend on co-infection or predisposing illnesses. Common metabolic diseases such as ascites may predispose poultry to infection with bacteria that are pathogenic to humans. Research is needed to discover how metabolic diseases and other infections may confer susceptibility to human pathogens and to reduce the incidence of such diseases.

e) A decrease of $10,580,000 in ongoing Animal Sciences research to provide savings to finance higher priority research initiatives.

ARS is recommending the termination of selected research projects within the Animal Sciences research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There are 14 specific research projects recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Animal Sciences research projects.

- -- Immunity and Diagnostics of Diseases and Parasites of Catfish
- -- Management of Termites as Urban Pests in the American Pacific
- -- Identification and Molecular Characterization of Agents Causing Poult Enteritis-Mortality Syndrome
- -- Tropical Aquaculture Feeds and Culture Technology: Development of Shrimp Feeds
- -- Formosan Subterranean Termite Control and Research Demonstration Program
- -- Ecologically-Based Technologies for Controlling Ixodes Scapularis and Reducing Lyme Disease
- -- Identification and Characterization of Quantitative Trait Loci Resistance to Disease in Chicken
- -- Catfish Genetics and Breeding Research

- -- Improve Production Efficiency in Aquaculture
- -- Optimizing Reproduction Efficiency to Enhance Profit and Sustainability of Range Beef Production
- -- Metabolism and Nutritional Management of Prolific Sows During Gestation and Lactation
- -- Animal Health Consortium
- -- Cool and Cold Water Aquaculture Production in Appalachia
- -- Development of Genetically Enhanced Fish and Feeds for Aquaculture Utilizing Specialized Grains
- -- General Reduction

OBJECTIVE 4: COMMODITY CONVERSION AND DELIVERY

4) A net decrease of $1,264,000 for Commodity, Conversion, and Delivery research consisting of:

a) An increase of $1,976,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $950,000 for research in support of **Agricultural Microbial/Insect Genomes**.

Note: See Agricultural Genomes under Plant Sciences.

Emerging pest species cause increasing damage to important U.S. agricultural production and export commodities and require high levels of pesticides for their control. For example, the continuing spread of insect pests of bees has had a devastating effect on crops dependent on bees for pollination. Evaluation of genetics of tolerance or resistance to the varroa mites in some bees is essential to combatting the effects they are having on honey bee colonies and pollination of important food crops. Other emerging arthropod pests cause major crop losses and affect human health which requires development of new genetically-based pest control technologies. Similarly, genetic characterization of beneficial biological control agents would help in identification of more virulent and specific strains. Identification of exotic and emerging insects can be augmented by use of genomic tools to complement conventional taxonomic characters which can provide the basis for rapid and more accurate identification of pests and biological control agents. These new resources will be used to accelerate development of new DNA-based species detection systems to ensure competitiveness in the global marketplace.

Development of new genomic tools will be combined with conventional methods to identify pollinators (bees), beneficials (biological control agents), and pests of crops (especially fruit flies, aphids, whiteflies, *Lygus* bugs, diamond back moth, etc.). Rapid identification of several major plant pests is not presently possible because of the apparent similarity of closely related species. Genetically- based technologies will allow more rapid and accurate identification of pest species to enhance movement of U.S. commodities into the global marketplace. Newly discovered molecular characters can be used to identify hard to identify species.

Outcomes

The proposed research will provide the means for maintaining and enhancing the quality and safety of the U.S. supply of food, fiber, feed, biofuels, medicines, and industrial products. It will also strengthen U.S. agricultural competitiveness in global markets by ensuring the continued genetic improvement of beneficial microbes, and shielding agricultural, pharmaceutical, and industrial production from genetic vulnerability caused by an inadequate supply of microbial genetic diversity.

ARS research in these areas supports Performance Goal 2.1.3.2: documented DNA base sequences of agricultural importance; Performance Goal 2.1.3.3: release of improved germplasm, varieties, and breeds based on effective use of genetic resources; and Performance Goal 2.1.3.4: improve methods for identifying useful properties of plants, animals, and other organisms, and for manipulating the genes associated with these properties.

- **Combine New Genomic Approaches to Characterizing and Improving the Productivity of Microbes of Industrial or Medicinal Importance** ($650,000).
  The proposed research will combine new genomic tools and approaches with conventional research methods to discover, characterize, and manipulate genes and genotypes of microbes (fungi, bacteria, actinomycetes) that produce vaccines or industrial products by fermentation and other biochemical processes. This research also will develop knowledge of the genomes of the plant parasitic nematode, soybean cyst nematode, and of the swine pest nematode *Ascaris*, in order to develop control strategies to improve plant and animal health.

- **Develop Genome in Insects of Interest Which Are Pollinators, Beneficial, or Pests of Crops** ($300,000).
  The continuing spread of varroa mite and tracheal mite in honey bee colonies has had a devastating effect on crops dependent on bees for pollination. Evaluation of tolerance or resistance to these mites in some bees is essential to combating their effect on honey bee colonies and thus pollination of important food crops. Identification of other exotic and emerging insect pests (such as aphids, whiteflies, and fruit flies), and their beneficial natural enemies can be augmented by using genomic tools to complement conventional taxonomic characters which will provide the basis for more accurate and rapid identification of pests and development of biological control agents.

c) An increase of $4,420,000 for research in support of **Postharvest Food Safety**.

Postharvest operations (slaughter and processing) are in many cases, a source of pathogen contamination of meat, poultry, and aquaculture products. They can also provide an opportunity to remove or inactivate pathogens previously acquired on the farm. Similarly, the processing of fruits and vegetables, many of which will not be cooked before consumption, offers similar opportunities for either contamination or clean-up. Pathogens develop resistance to antibiotics, antimicrobials, and traditional measures used for pathogen control. Because so few effective treatments are available for fresh fruits and vegetables, preventing the development of resistance to antimicrobials is particularly important. Successful technologies and strategies to eliminate, reduce, or suppress human pathogens, are particularly needed for commodities previously associated with foodborne illness or at risk of becoming vehicles for human pathogens. Novel methods of minimal processing must be based on an understanding of the modes of contamination, the microbial ecology of the food product, and the effectiveness of various decontamination technologies. Investigations must also determine whether suppression of spoilage would create a unique niche for contaminant human pathogens. Detection and quantitative measurement of pathogens at all critical points during food processing is needed to provide the necessary data to carry out risk assessments, and identify the areas where interventions are most critically needed.

Outcomes

The proposed research will result in fewer pathogens in the processing environment for foods of both plant and animal origin. Effective targeted treatments and handling practices for fruits and vegetables will not only result in fewer pathogens, but will also maintain their fresh attributes essential for good health and consumer acceptance. Food will no longer be a vehicle for transmitting antibiotic resistance from pathogens or other bacteria to consumers. There will be substantial benefits to society by preventing illnesses and deaths. Disruptions in normal, healthy eating patterns resulting from food scares will be prevented. Enhanced consumer confidence in food products of both plant and animal

origin will substantially benefit producers.

ARS research in these areas supports the objective of maintaining a safe food supply through Performance Goal 2.2.1.1: transfer knowledge developed by ARS to industry and regulatory agencies.

Specific Program Thrusts

- **Develop Data on Pathogen Control in Fruits and Vegetables** ($2,100,000).
The research will develop data on the characteristics of fruits and vegetables associated with high quality products that resist growth of pathogens. This information is necessary to form the basis of a breeding program to optimize fruit and vegetable quality. The research will delineate the ecology of foodborne pathogens during production, harvesting and handling, including their environmental sources. It will also determine if inhibitors of normal surface flora, such as antagonistic microorganisms and natural plant pathogens, allow for preferential growth of zoonotic pathogens. The effects of phytochemicals and environmental conditions on growth and survival of E. coli 0157:H7, salmonella, and campylobacter on the surface of fruits and vegetables will be quantified, particularly in relationship to biofilm development. Research will also develop proper handling procedures and treatments, including efficacious rinses and other procedures to reduce pathogen populations. These treatments for fruits and vegetables will optimize traditional and nontraditional methods of inhibiting pathogens, using both chemical and physical control techniques and strategies, including irradiation, radio frequency radiation, and steam pasteurization. They will be applied to both the outer and inner surfaces and to fresh cut produce. Development of these technologies will be supported by improved methods to detect and quantify bacteria.

- **Pathogen Control During Slaughter and Processing** ($700,000).
High throughput processing lines for poultry place a high demand on inspection systems. With the advent of HACCP for inspection, new tools are needed to provide automated and rapid inspection to ensure that poultry are free of contamination and pathogens. Research is needed to develop methods to detect the presence of pathogens and contamination on the surface of poultry through remote sensing and to integrate detectors into a quality control system.

- **Investigate Antimicrobial Resistance** ($1,620,000).
Information is needed to better understand the adaptability of microorganisms to their environment in various food systems, through both additional toxin formation and resistance to microbial inhibitors. The research will develop molecular characterization methods to facilitate the identification of resistant bacterial pathogens detected in food products, and tracing of the organisms to their source (e.g., environment, manure, water, animal feed). This research will define physiological and/or genetic mechanisms that microbes utilize to become resistant to traditional food safety barriers, such as heat or cold, low pH, low water activity, and disinfectants, and transfer of resistance to other organisms. Culture collections of resistant and nonresistant bacteria and fungi will be established. The information is critical to the development of prevention and intervention pathogen control strategies for both animal- and plant-based food products which will delay or prevent the acquisition of resistance. It will also provide the scientific knowledge to support the needs of the action agencies.

d) <u>A decrease of $8,610,000 in ongoing Commodity Conversion and Delivery research to provide savings to finance higher priority research initiatives.</u>

ARS is recommending the termination of selected research projects within the Commodity Conversion and Delivery research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There are 17 specific research projects recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Commodity Conversion and Delivery research projects.

-- Flavor Optimization of Major Food Crops Through Control of Metabolic Processes
-- Conversion of Crops to Products with Higher Added Value Through Directed Molecular Evolution
-- Thermomechanical Processing of Natural Polymers
-- Enhanced Use of Plant Proteins: Identifying, Isolating and Relating Structures to Properties
-- Biotechnology R&D Corporation
-- New Crops for Industrial Products
-- Novel Carbohydrate-Based Materials via Bioconversion Processes
-- Bioprocess and Metabolic Engineering Technologies for Biofuels and Value-Added Co-Products
-- Comparative Textural Analysis of Fresh and Fresh-Cut Fruits and Vegetables
-- Improving Quality of Fresh and Fresh-Cut Produce by Preventing Deterioration in Cold Storage
-- Postharvest Handling and Mechanization to Minimize Damage for Fruits
-- Improved Peanut Product Quality and Bioactive Nutrient Composition with Genetic Resources
-- Value-Added Products from Fruit and Vegetable Processing Wastes
-- Harvesting and Ginning Technologies for Stripper Cotton
-- New Processes for Generating Valuable Co-Products from Corn Fiber
-- New Processes for Obtaining Higher Value-Added Products from Agricultural Lipids
-- Develop, Evaluate and Transfer Technology to Improve Efficiency and Quality in Peanuts
-- General Reduction

OBJECTIVE 5: HUMAN NUTRITION

5) A net increase of $20,412,000 for Human Nutrition Research consisting of:

a) An increase of $397,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $20,250,000 for research in support of **Phase 3 of the President's Human Nutrition Research Initiative**.

A healthy human diet is essential for maintaining the health and vigor of the population and enhancing longevity without risk of chronic disease. The causes of malnutrition and nutritionally related diseases in this country are multiple, complex and not fully understood. Research conducted at ARS' human nutrition research centers has indicated that what and how much is consumed profoundly affects growth, development, and aging. For diseases strongly linked to diet the estimated cost of medical treatment and care exceeds $200 billion per year. Clearly, any progress that can be made to prevent the occurrence of disease through improved diet will be beneficial and cost-effective. The President's human nutrition research initiative was launched in Fiscal Year 1998. The goals of the initiative are to: reduce health care costs and enhance the quality of life by further defining the relationship between diet and health; improve the scientific basis of more effective food assistance programs; generate a more nutritious food supply; improve resistance to infection and immune disorders; promote changes in diet by understanding the factors that affect food choices; and extend dietary guidance to nutritionally vulnerable groups by determining how food consumption at critical points in the life cycle affects risk of disease. In the first phase of the initiative, emphasis was placed on the dietary

requirements in children. In the second phase, cutting edge research approaches, such as molecular biology, were applied to human nutrition to identify the role of nutrients to promote health throughout the life cycle. In the third phase, emphasis will be on the identification and measurement of the active components of a healthy diet; determination of the factors that maintain a healthy body weight; the role of diet in the etiology and prevention of bone disease; and importance of diet in maintaining optimal neurological function throughout life.

Outcomes

The proposed research will result in: improved understanding of the factors that control energy balance and tendency for weight gain; greater understanding of changes in body composition throughout the life span; increased brain and cognitive function throughout life; and improved prevention of osteoporosis, bone loss, fracture and disability. The proposed research will also provide information leading to a reduction in the incidence of nutritionally-related diseases, and to a more healthy and productive population. This in turn will lead to a decrease in the staggering costs associated with the treatment of nutritionally-related diseases.

ARS research in these areas supports Performance Goal 3.1.1.1: indicators of function determined and related to diet and health; Performance Goal 3.1.2.1: transfer new measurement techniques and data to users, release results of surveys, and disseminate effective nutrition intervention strategies; and Performance Goal 3.1.3.1: demonstrate improved nutritional quality.

Specific Program Thrusts

- **Update the National Nutrient Databank** ($2,200,000).
  The National Nutrient Databank is the database for the foods consumed in this country and is the foundation for food composition tables throughout the world. All epidemiological examinations of the effects of diet on health are dependent on the quality of the data. Nutrition scientists, health educators, and medical practitioners require an accurate database of the nutrient content of foods in order to understand which food choices result in a healthy diet. In addition, having an accurate database is essential for making dietary recommendations since it is necessary to know with certainty which nutrients are contained in particular foods. Despite its position as the preeminent nutrient database, many food items are not included due to the rapid changes in the food supply; in some cases the data are as much as 30 years out of date. The database is in the process of being totally redesigned, but additional food analyses need to be made to keep the data current. Having updated information will ensure that research in nutrition is based on a solid understanding of the nutrient content of foods and that information supplied to consumers is adequate for them to make proper choices from the food information labels.

- **Develop Food Composition Methods** ($1,200,000).
  The maintenance of an accurate nutrient database of food composition is dependent on the availability of accurate and robust methods of analysis for foods. ARS maintains the only laboratory whose mission is to develop new and improved methods of analyses. Concentrating on nutrients suspected to be of importance in terms of human health, new methods of chemical analysis will be developed that can accurately, economically, and quickly determine the levels of a variety of nutrients in foods. The data to be obtained will be maintained in the National Nutrient Database. Having this information available will enable nutrition researchers to study the relationship between the intake of certain foods and the changes observed in risk factors for various diseases.

- **Determine Healthy Body Weight** ($2,500,000).
  Obesity is a major health problem in this country. Although great emphasis has been placed on management of obese individuals and strategies for weight reduction, relatively little is know about health risks associated with mild to moderate increases in weight or the risks associated with being under weight. Whether specific micronutrient needs increase when obese people lose weight and body

fat needs to be determined. ARS has the only direct calorimeters in this country for studying energy expenditure in human subjects of all ages. Research will be directed at determination of the true energy expenditures of children, pregnant women, adults, and the elderly with different genetic makeup and patterns of physical activity. By studying the relationship between fetal growth, birth weight, and infant growth, it will be possible to understand how nutrition in early life affects health outcomes later with special reference to degenerative diseases such as diabetes, heart disease and high blood pressure. Additionally, the physiological and neurological regulators of energy consumption and expenditure will be examined to determine how they are linked genetically. The results of this research will help to define healthy weight and help to understand how food consumption and physical activity habits can be modified.

- **Research the Role of Nutrition in Bone Growth and Maintenance** ($3,600,000).
Osteoporosis is a loss of bone mass that affects primarily, but not exclusively, postmenopausal women. It leads to debilitating bone fractures. The estimated annual costs of this disease is over $10 billion for care alone. Research will be conducted to identify the nutritional, biochemical, and hormonal regulators of skeletal mineralization during infancy, childhood and adolescence and how they relate to subsequent development of osteoporosis. Special emphasis will be placed on examining the interplay between physical activity and dietary factors, as well as an examination of the most practical way to assess Vitamin D status in older populations in preventing osteoporosis and bone loss.

- **Develop Biomarkers of Nutritional Status** ($3,500,000).
Nutritionally-related diseases typically develop over a period of many years. Often disease symptoms develop without any prior evidence of the underlying disease, yet very little is known about disease risk prior to that point. Furthermore, many nutritional studies using human subjects are dependent on studying biomarkers to understand the nature of nutritional requirements since it is necessary to ensure that subjects are not exposed to risk while being studied. In order to fully evaluate the role of diet in maintaining health, meaningful measurements of biochemical and physiological function that are related to the nutritional status of an individual and which are indicative of true long term risk for diseases, such as cancer and heart disease, need to be developed. The availability of such biomarkers will be of great benefit to understanding how diet and particular nutrients affect disease risk long before the development of any deficiency symptoms. With such information, nutrition researchers and the health care community will have the ability to accurately predict the long term consequences of diet on individuals.

- **Examine Cognition and Brain Function** ($3,450,000).
There is growing evidence to suggest that what is consumed can affect the development of the central nervous system and have an impact on how well people learn, how they function mentally, and how the function of the brain deteriorates in many people as they age. However, it is still not clear how the process occurs and what the key steps are in growth, development, and aging that are affected by diet and which might be delayed or prevented by nutritional manipulation. Research will be directed at determination of the environmental, dietary, physiological, and psychological stressors on nutrient requirements for robust mental function. Special emphasis will be placed on defining the key developmental periods for nutritional imprinting that affect the function of the brain later in life, and how diet affects neural development at conception through gestation. The results of this research are critical to understanding how diet might be used to improve mental capacity at all stages of life.

- **Diet and Immune Function** ($2,100,000).
Infectious diseases are a major cause of mortality and morbidity in all segments of the population. Despite the development of effective antibiotics. The emergence of antibiotic resistant mircroorganisms as well as the appearance of exotic infectious agents, such as HIV, has become cause for alarm. An understanding of how diet affects the immune system is in its infancy, but recent research results from ARS scientists have pointed out for the first time that the nutritional status of a host can affect the

disease causing potential of a human pathogen virus. Such results may explain why some infections are benign in certain populations, but cause mortality in others. Additional research will be conducted to determine the effects of diet on the immune system to determine if other infectious agents can also alter their pathogenicity in response to the diet of the host. The mechanism by which diet alters the immune system will be investigated. The results will lead to dietary recommendations that can reduce the incidence of infection and immune related diseases.

- **Role of Nutrition Throughout the Life Cycle** ($1,300,000).
Childhood development is known to impose the greatest need for nutrients within the life span. However, an understanding of what nutrients are required, their levels in the diet, and at what point in the development process they are critical is incomplete. Similarly, an understanding of the changing need for nutrients that occurs as individuals age is incomplete. Studies will be conducted to determine the relationship between diet and bone and skeletal growth; cognitive and neurological development; and the factors that lead to obesity in children. Nutritional requirements that are needed to delay the onset of diseases associated with aging, such as cardiovascular disease, cancer, Alzheimer's disease, macular degeneration, and osteoporosis will be researched. The results will help form the basis of sound dietary recommendations that meet age dependent needs throughout life. Moreover, in collaborative ARS-wide research the findings also will be used with existing breeding and bio-technologies to develop foods rich in compounds that will promote health.

- **Examine Dietary Survey Methodology** ($400,000).
Development of feeding programs depends critically on assessment of food consumption by target groups. Current interview methodologies are time consuming and expensive. Research will be conducted to develop telephone surveys to reduce the cost of food consumption surveys and enhance their accuracy.

c) A decrease of $235,000 in ongoing Human Nutrition research to provide savings to finance higher priority research initiatives.

ARS is recommending the termination of selected research projects within the Human Nutrition research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There is 1 specific research project recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Human Nutrition research projects.

-- Dietary Assessments of Rural Older Persons
-- General Reduction

OBJECTIVE 6: INTEGRATION OF AGRICULTURAL SYSTEMS

6) A net increase of $751,000 for Integration of Agricultural Systems Research consisting of:

a) An increase of $258,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $1,500,000 for research in support of **Sustainable Ecosystems**.

Resource managers, public officials, business leaders, and concerned citizens throughout the Nation are working toward new approaches to manage regional growth and ensure the viability of the ecosystems. Central to the success of these new consensus-based adaptive strategies is the ability to understand, monitor, and model ecosystems. Taken together, these will enable managers to assess and predict the outcomes of various decision scenarios. As a result, science and technology are increasingly called upon to evaluate the current state of ecosystem structure and function, assess the impacts of stressors on ecosystem goods and services, and identify management approaches that prevent further adverse impacts, conserve critical habitats, and restore damaged systems to a viable state. There is a demand for reliable information that integrates biological, chemical, and physical sciences with social and economic analyses to devise strategies and technologies for conservation and restoration of the ecosystems.

Outcomes

The proposed research is designed to significantly improve the understanding of ecosystems and the ability to manage them. ARS participation in the initiative will ensure an effective multidisciplinary approach to ecosystem sustainability and a practicable link to transfer new science and technology to action agencies.

ARS research in these areas supports Performance Goal 2.1.2.1: demonstrate new integrated technologies to protect plants, animals and ecosystems; Performance Goal 4.1.1.1: demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base; Performance Goal 4.1.1.2: experimentally demonstrate the appropriateness of watershed-scale technologies and practices that protect the environment and natural resources; Performance Goal 4.1.3.1: demonstrate cropland and grazingland management strategies that improve productivity and efficiency of croplands and grazinglands; Performance Goal 4.2.1.1: risk-reduction strategies and methods transferred to the Nation's agricultural industry; Performance Goal 4.2.2.1: improve strategies and technologies that reduce the effects of extreme weather variability; Performance Goal 4.3.1.1: deliver integrated pest management strategies that are cost-effective and protect natural resources, human health, and the environment; and performance Goal 4.3.2.1: demonstrate the effectiveness of integrated agricultural producing systems in the improvement of natural resources and protection of the environment.

Specific Program Thrusts

- **Implement the CENR Research and Monitoring Framework** ($300,000).
  Nonpoint sources of pollutants, such as runoff from agricultural, suburban, and urban areas contribute to environmental degradation. ARS, in cooperation with other CENR (Committee on Environment and Natural Resources) agencies, will select four or more watersheds where agricultural production contributes to soil, water, and air pollution. ARS is currently involved in the implementation of the CENR Mid-Atlantic pilot of the National Environmental Research and Monitoring Framework and ARS plans to participate in a second fully integrated pilot in a region with substantially difficult ecosystem processes in year 2000. Farm and watershed-scale models and decision support systems will be used to recommend practices for managing the agricultural production and water systems. New cropping systems will be developed that reduce dependence upon inorganic fertilizers and pesticides, and use cover crops, smother crops, and new crop rotations. ARS will develop tools and assessment methods that farmers, ranchers, and other land managers can use to monitor soil quality.

- **Advance Ecological Science for Sustainable Livestock Management Systems** ($600,000).
  Manure management for swine (i.e., handling, storage, reuse as a nutrient) must be researched to utilize nutrients more efficiently in crop and swine production systems to reduce excretion of nutrients that may adversely affect the environments. Decision support systems are needed to allow producers to

optimize management practices for swine production and manure application while protecting the environment.

- **Predict Impacts and Restore the Viability of Damaged Riparian Zones and Coastal Habitats** ($300,000).
  Natural or constructed conservation buffers (riparian areas, wetlands, biofilters, and buffer strips) can remove sediments and contaminants generated by agricultural activities before they reach surface waters. The Clean Water Action Plan calls for farmers to create two million miles of biofilters adjacent to waterways by year 2002, construct 100,000 acres of wetlands by year 2005 and restore 25,000 miles of stream corridors by 2005 without knowing the capabilities of these practices. Research in this area will identify processes controlling the effectiveness of conservation buffers for removal of pollutants. This will require integrated knowledge of plants, microbial processes, soils, landforms, and hydrology. At present, knowledge and design options are limited.

- **Conduct Integrated Ecosystem Risk Assessments** ($300,000).
  Risk assessment results provide a basis for comparing different management options, enabling decisionmakers and the public to make informed decisions about the management of ecological resources. ARS will play a lead role in the development of integrated management models and decision support systems for risk assessments that link experimental and observational studies across spatial scales to forecast ecosystem response to multiple stresses. Advanced irrigated and nonirrigated crop production systems, animal production and grazinglands systems, drainage systems, and other sustainable agricultural practices will be included in the models being developed to improve water quality, prevent soil erosion, reduce air pollution, conserve water, reduce energy requirements, and optimize agricultural production. Multiple stressors (changes in land and other resource uses, invasive species, pollution, extreme natural events, and climate change) also will be assessed and evaluated for their potential impacts on aquatic habitats, riparian zones, stream corridors, and wetlands in the selected sites.

c) A decrease of $1,007,000 in ongoing Integration of Agricultural Systems research to provide savings to finance higher priority research initiatives.

ARS is recommending the termination of selected research projects within the Integration of Agricultural Systems research program. The savings achieved will be redirected to finance higher priority agricultural research initiatives recommended in the President's budget.

While these projects that have been identified for termination have contributed to the solution of important agricultural problems, they are considered to be less essential to continue given priorities identified above. There are 2 specific research projects recommended for reduction or termination under this objective. A one-tenth percent, across the board reduction is also recommended for ongoing Integration of Agricultural Systems research projects.

-- Warmwater Foodfish Health Management Research
-- Anaerobic Microbiological Processes in Animal Waste Management
-- General Reduction

OBJECTIVE 7: AGRICULTURAL INFORMATION AND LIBRARY SERVICES

7) A net increase of $2,209,000 for Agricultural Information and Library Services consisting of:

a) An increase of $238,000 for pay costs.

These funds are requested to help defray the costs of financing the anticipated Federal pay raise of 4.4 percent in FY 2000.

b) An increase of $2,000,000 for an Initiative on Digital Libraries for Rural America.

The National Agricultural Library (NAL) collection supports the information needs of researchers and policy makers in ARS and other USDA agencies. For NAL to continue to provide cost-effective access to the vast quantities of data and information that are vital to the rural agricultural community, it is essential to capitalize on available and emerging technologies, especially the Internet.

The networked information resources and pilot projects implemented since the inception of the Agriculture Network Information Center (AgNIC) in 1995 have demonstrated success in identifying, organizing and presenting a variety of information resources from a well organized and user-friendly hub on the Internet. The NAL serves as a leader in the information community that includes University libraries.

Outcomes

The proposed increase will ensure the quality, quantity, and accessibility of agricultural information to rural America by creating digital libraries in rural America and increasing the efficiency of information searches. This initiative will use new technology to improve the way information, in forms such as, text, multi-media, geo-spatial and databases, is published, organized, and retrieved.

The proposed increase also will ensure that NAL and University libraries can meet the increasing needs of the agricultural community for rapid delivery of print and electronic information regardless of where it is physically located or maintained. Rural America will have fast, easy, and continuous access to information that enhances economic opportunities, reduces risks, protects natural resources, enhances global competitiveness, and creates a healthier and better educated citizenry.

The proposed increase in these areas supports Initiative 2-Performance Goal 2.1.1: implemented selection guidelines for the electronic resources to be acquired and used by NAL; Initiative 2-Performance Goal 2.1.2: expanded representation of electronic formats such as Internet resources, online databases, and digital documents in AGRICOLA and NAL's online catalog; Initiative 2-Performance Goal 2.1.3: a gateway is provided to a large body of electronic information on agriculture over a network such as the Internet; Initiative 2-Performance Goal 2.1.4 demonstrate increased use of agricultural information by institutions of higher education; Initiative 2-Performance Goal 2.2.1: the time for processing requests for services and delivering the information requested is further reduced; Initiative 2-Performance Goal 2.2.2: the gap between the time that information is published and made available in NAL-produced databases is further reduced; Initiative 2-Performance Goal 2.2.3: expanded provision of Internet and other technology-related training programs for NAL customers; Initiative 2-Performance Goal 2.3.1: technology-related training programs for NAL customers; Initiative 2-Performance Goal 2.3.1: establishment of a national archive for agriculture literature that serves as a centralized storage facility for archival copies prepared by cooperators in the program; and Initiative 2-Performance Goal 2.3.2: development of a program for monitoring quality of electronically archived materials to ensure that the data remain accessible.

Specific Program Thrusts

- **Provide Enhanced Information Services to Rural America** ($2,000,000).
  The Internet offers a unique opportunity to provide enhanced information services to rural America. The NAL and land grant universities have Centers of Excellence on subjects of critical importance to American agricultural including food safety, IPM, grazing lands, horticulture, swine production, and aquaculture. Programs are needed to ensure that electronic methods are developed to make available the information from the Centers of Excellence to rural America.

Approximately 80 percent of the funds would go to individual land grant universities in multi-year grants of $200,000 to $500,000 a year to set up information centers in specific and distinct areas, such as agricultural economics, IPM, water quality, animal husbandry, food safety, and sustainable agriculture. The remaining funds would go to the NAL to coordinate implementation, including activities such as setting up common technical standards, identifying gaps, establishing new services, and deploying better tools for searching and navigating. The proposal would build on existing efforts such as AgNIC (Agricultural Network Information Center), which currently has participation from the NAL and institutions such as Cornell, Iowa State, the University of Arizona, the University of Nebraska-Lincoln, and Washington State University.

c) A decrease of $29,000 for Agricultural Information and Library Services.

The Agricultural Research Service is proposing a reduction in research and information programs. These savings will be redirected to finance higher priority agricultural initiatives as recommended by the Department in the FY 2000 budget.

United States Department of Agriculture
Agricultural Research Service

CONTINGENCY RESEARCH FUND--FY 1998

The Contingency Research Fund, established by Congress in Fiscal Year 1962, is designed to provide an immediate source of funds to meet unforeseen research needs. Releases from the fund are made to respond to emergency funding needs, such as controlling outbreaks of diseases or pest problems or to pursue scientific breakthroughs where it appears inadvisable to wait for consideration of additional funding through the regular budget process. In allocating these funds, the Agency policy is to make no commitment beyond the current fiscal year.

Releases	Amount
Wheat Scab Initiative	
St. Paul, Minnesota	$137,007
Avian Influenza Research	
Athens, Georgia	200,000
Repair Main Warehouse Roof	
Greenport, L.I., New York	30,000
Hog Cholera Research	
Greenport, L.I., New York	200,000
Install Underground Bypass Line	
Greenport, L.I., New York	79,117
Storm Damage to Trees and Electricity Transformer	
Salinas, California	155,410
Hail Storm Damage to Roof and Satellite	
Dawson, Georgia	82,158
High Wind Damage to Roof, Irrigation and Trees	
Byron, Georgia	44,831
Total, Contingency Research Fund	928,523

Agricultural Research Service

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998		1999		2000	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
ALABAMA, Auburn	$3,082,754	35	$3,751,500	41	$4,111,500	41
ARIZONA						
Phoenix	7,725,306	109	7,509,600	109	8,319,600	109
Tucson	3,513,477	41	3,041,200	41	3,851,200	42
Total	11,238,783	150	10,550,800	150	12,170,800	151
ARKANSAS						
Booneville	2,153,140	20	2,472,500	20	2,742,500	20
Fayetteville	1,300,055	12	1,267,400	12	1,537,400	12
Little Rock	5,744,181	2	6,491,300	2	10,243,800	2
Pine Bluff	495,264	3	484,000	3	484,000	3
Stuttgart	2,936,769	26	4,935,500	44	4,125,500	40
Total	12,629,409	63	15,650,700	81	19,133,200	77
CALIFORNIA						
Albany	22,061,954	208	26,433,600	236	26,541,500	234
Davis	1,888,668	25	1,574,700	25	1,844,700	25
Fresno	6,977,483	79	6,725,100	79	7,225,200	79
Riverside	3,981,466	51	4,511,500	57	4,511,500	57
Salinas	2,564,345	34	2,568,200	35	2,568,200	35
San Francisco	4,869,255	34	5,207,800	35	7,727,800	35
Shafter	915,171	16	1,032,500	16	1,032,500	16
Total	43,258,342	447	48,053,400	483	51,451,400	481
COLORADO						
Akron	1,326,309	24	1,217,100	24	1,217,100	24
Fort Collins	11,260,313	135	10,777,500	137	11,587,500	142
Total	12,586,622	159	11,994,600	161	12,804,600	166
DELAWARE						
Newark	1,361,080	14	1,316,900	14	1,586,900	14
DISTRICT OF COLUMBIA						
National Arboretum	7,095,644	96	8,623,900	96	8,445,000	96
Headquarters						
Federal						
Administration	34,649,796	463	37,981,800	463	37,981,800	463
Centrally Financed						
Services	9,871,968	--	8,681,300	--	8,681,300	--
Subtotal	44,521,764	463	46,663,100	463	46,663,100	463
Total	51,617,408	559	55,287,000	559	55,108,100	559

Agricultural Research Service

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998		1999		2000	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
FLORIDA						
Brooksville	797,585	10	1,168,300	16	1,438,300	16
Canal Point	1,437,918	23	1,472,800	24	1,472,800	24
Fort Lauderdale	1,040,781	10	1,288,500	11	1,558,500	11
Fort Pierce	6,304,309	72	6,672,100	78	7,212,100	78
Gainesville	10,052,455	141	9,853,100	142	10,385,600	142
Miami	2,317,864	28	2,503,600	34	3,043,600	34
Winter Haven	1,211,994	18	1,248,600	18	1,248,600	18
Total	23,162,906	302	24,207,000	323	26,359,500	323
GEORGIA						
Athens	16,845,487	203	19,286,900	224	22,031,900	236
Byron	2,417,680	30	2,714,900	31	2,714,900	31
Dawson	2,101,991	30	2,759,400	31	2,309,400	30
Griffin	1,592,603	20	1,495,400	20	1,495,400	20
Tifton	7,567,243	93	7,394,300	93	7,934,300	94
Total	30,525,004	376	33,650,900	399	36,485,900	411
HAWAII, Hilo	8,718,620	71	8,774,500	71	7,331,800	71
IDAHO						
Aberdeen	2,523,906	23	2,799,700	29	2,250,900	26
Boise	1,808,263	20	1,769,500	20	2,309,500	21
Dubois	1,978,492	18	2,040,100	18	2,040,100	18
Kimberly	2,564,518	40	2,523,700	40	2,793,700	40
Total	8,875,179	101	9,133,000	107	9,394,200	105
ILLINOIS						
Peoria	26,563,778	257	27,520,600	259	23,459,700	248
Urbana	3,726,507	42	3,574,700	42	3,435,900	35
Total	30,290,285	299	31,095,300	301	26,895,600	283
INDIANA, W. Lafayette	4,937,485	48	5,080,100	49	5,620,100	50
IOWA, Ames	26,693,083	347	29,544,100	383	31,931,100	378
KANSAS, Manhattan	7,841,830	73	7,374,800	74	7,151,200	74
LOUISIANA						
Baton Rouge	2,742,215	24	2,189,800	25	2,684,800	25
New Orleans	24,732,007	233	24,435,500	234	18,897,700	227
Total	27,474,222	257	26,625,300	259	21,582,500	252

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GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998 Amount	1998 Staff Years	1999 Amount	1999 Staff Years	2000 Amount	2000 Staff Years
MARYLAND						
Beltsville	122,702,992	1,291	115,992,300	1,341	125,493,000	1,366
Frederick	2,550,194	27	2,500,100	28	2,770,100	28
Total	125,253,186	1,318	118,492,400	1,369	128,263,100	1,394
MASSACHUSETTS, Boston	14,213,392	14	14,401,000	14	16,598,500	14
MICHIGAN, East Lansing	4,089,434	47	3,906,100	47	3,746,900	44
MINNESOTA						
Morris	2,374,869	34	2,383,400	34	2,923,400	34
St. Paul	5,510,442	53	5,338,800	53	5,654,500	53
Total	7,885,311	87	7,722,200	87	8,577,900	87
MISSISSIPPI						
Mississippi State	7,533,478	88	6,771,000	97	7,311,000	97
Oxford	7,769,191	68	8,208,300	69	8,118,300	68
Poplarville	1,077,867	15	1,230,000	16	1,005,000	15
Stoneville	16,805,189	172	20,095,800	193	19,431,000	192
Total	33,185,725	343	36,305,100	375	35,865,300	372
MISSOURI, Columbia	5,459,346	59	6,163,400	60	5,901,500	59
MONTANA						
Miles City	2,228,850	21	2,128,100	21	1,903,100	20
Sidney	3,032,188	27	3,791,300	36	4,691,300	37
Total	5,261,038	48	5,919,400	57	6,594,400	57
NEBRASKA						
Clay Center	13,932,140	123	14,967,100	129	16,265,600	130
Lincoln	4,800,469	50	4,474,900	50	5,696,800	50
Total	18,732,609	173	19,442,000	179	21,962,400	180
NEW MEXICO						
Las Cruces	2,299,869	23	2,351,600	23	2,351,600	23
NEW YORK						
Greenport	9,273,429	51	8,816,000	51	9,986,000	55
Ithaca	6,222,948	44	6,348,200	50	6,093,200	50
Total	15,496,377	95	15,164,200	101	16,079,200	105

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GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998 Amount	1998 Staff Years	1999 Amount	1999 Staff Years	2000 Amount	2000 Staff Years
NORTH CAROLINA						
Raleigh	5,830,519	57	6,026,100	57	6,042,900	57
NORTH DAKOTA						
Fargo	9,748,416	110	10,322,900	111	10,592,900	111
Grand Forks	7,719,117	60	7,607,600	61	9,587,600	61
Mandan	2,594,218	34	2,582,600	34	2,852,600	34
Total	20,061,751	204	20,513,100	206	23,033,100	206
OHIO						
Columbus	829,012	8	729,800	8	999,800	8
Coshocton	1,084,954	14	946,200	14	1,216,200	14
Wooster	2,388,270	34	2,309,700	34	2,121,800	32
Total	4,302,236	56	3,985,700	56	4,337,800	54
OKLAHOMA						
El Reno	4,589,800	42	4,404,600	43	5,709,600	43
Lane	1,638,585	26	1,690,500	26	1,690,500	26
Stillwater	2,708,537	31	2,517,100	31	2,382,900	31
Woodward	1,737,493	21	1,514,300	22	1,514,300	22
Total	10,674,415	120	10,126,500	122	11,297,300	122
OREGON						
Burns	709,313	5	906,900	6	1,446,900	6
Corvallis	6,822,610	84	6,951,900	84	5,510,900	79
Pendleton	1,408,559	20	1,411,900	20	1,681,900	20
Total	8,940,482	109	9,270,700	110	8,639,700	105
PENNSYLVANIA						
University Park	3,233,738	38	3,124,300	38	3,664,300	38
Wyndmoor	22,335,658	215	25,501,100	234	26,130,000	240
Total	25,569,396	253	28,625,400	272	29,794,300	278
SOUTH CAROLINA						
Charleston	2,592,657	33	2,543,600	33	2,813,600	33
Clemson	1,799,013	27	1,950,100	27	1,950,100	27
Florence	2,196,977	26	2,094,700	26	2,589,700	26
Total	6,588,647	86	6,588,400	86	7,353,400	86
SOUTH DAKOTA						
Brookings	3,349,343	26	2,297,700	26	2,297,700	26

Agricultural Research Service

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998 Amount	1998 Staff Years	1999 Amount	1999 Staff Years	2000 Amount	2000 Staff Years
TEXAS						
Beaumont	1,198,111	14	1,322,200	14	1,097,200	13
Bushland	2,293,246	34	2,281,700	34	3,091,700	34
College Station	12,343,034	146	13,378,100	159	14,248,400	165
Houston	10,953,097	10	11,107,100	10	14,147,100	10
Kerrville	2,632,335	43	2,629,900	43	2,629,900	43
Lubbock	3,955,211	59	4,487,200	68	4,622,200	66
Temple	3,156,876	43	3,073,400	43	4,513,400	43
Weslaco	8,618,056	115	8,476,500	115	8,296,500	113
Total	45,149,966	464	46,756,100	486	52,646,400	487
UTAH, Logan	4,747,838	46	4,785,000	47	5,055,000	47
WASHINGTON						
Prosser	2,486,475	30	2,435,000	30	2,705,000	30
Pullman	8,285,703	94	9,078,900	103	8,495,800	101
Wenatchee	1,358,430	25	1,360,200	25	1,360,200	25
Yakima	4,224,558	72	3,907,400	72	3,907,400	72
Total	16,355,166	221	16,781,500	230	16,468,400	228
WEST VIRGINIA						
Beckley	4,596,432	62	4,423,400	62	4,198,400	61
Kearneysville	6,254,032	63	6,318,200	64	6,588,200	64
Leetown	222,731	1	1,125,000	10	900,000	9
Total	11,073,195	126	11,866,600	136	11,686,600	134
WISCONSIN, Madison	6,177,939	61	6,249,700	61	6,216,800	61
WYOMING						
Cheyenne	1,839,677	25	1,633,200	25	2,173,200	25
Laramie	2,018,465	25	2,417,800	31	2,417,800	31
Total	3,858,142	50	4,051,000	56	4,591,000	56
PUERTO RICO						
Mayaguez	2,426,345	37	2,335,500	37	2,335,500	37
OTHER COUNTRIES						
Argentina, Buenos Aires	537,371	--	461,800	--	461,800	--

Agricultural Research Service

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998 Amount	1998 Staff Years	1999 Amount	1999 Staff Years	2000 Amount	2000 Staff Years
OTHER COUNTRIES (CONTINUED)						
France, Montpellier	1,878,309	2	1,943,300	2	2,213,300	2
Panama,						
Panama City	718,580	5	892,900	5	892,900	5
Total	3,134,260	7	3,298,000	7	3,568,000	7
Extramural and Funds Administered from Headquarters-Held Funds	9,445,920	--	58,312,800	--	37,324,000	--
Contingency Research Fund	a)	--	928,500	--	928,500	--
Repair & Maintenance of Facilities	18,375,223	--	18,262,400	--	18,262,400	--
Unobligated Balance	2,793,392	--	--	--	--	--
Subtotal, Available or Estimate	745,023,474	7,431	813,018,000	7,762	826,938,000	7,762
Allotment to Forest Service	223,144	--	--	--	--	--
Transfer from Office of Congressional Relations	(129,000)	--	--	--	--	--
Transfer from Department of State	(16,000)	--	--	--	--	--
Transfer from Office of Civil Rights	(169,618)	--	--	--	--	--
Transfer from Agency for Int'l. Development (AID)	(550,000)	b) --	--	--	--	--
Transfer from the Office of National Drug Control (ONDCP) for Anti-Drug Research and Related Matters	--	--	(4,500,000)	--	--	--

Agricultural Research Service

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS

1998 Actual and Estimated 1999 and 2000

Location	1998 Amount	1998 Staff Years	1999 Amount	1999 Staff Years	2000 Amount	2000 Staff Years
Emergency Supplemental Appropriations for Counter Drug Research and Development	--	--	(23,000,000)	--	--	--
1998 Rescission	223,000	--	--	--	--	--
Pay Costs	--	--	--	--	9,930,000	--
TOTAL, Appropriation	744,605,000	7,431	785,518,000	7,762	836,868,000	7,762

a) Obligations incurred in 1998 under the Contingency Research Fund in the amount of $928,523 are reflected in the amount for recipient locations.

b) Collaborative Research Program Funds from AID are designated as no-year funds. Unobligated balance of $550,000 in 1998 is available for obligation in 1999.

AGRICULTURAL RESEARCH SERVICE
STATUS OF PROGRAM

ARS conducts and finances research under seven major program activities: Soil, Water, and Air Sciences; Plant Sciences; Animal Sciences; Commodity Conversion and Delivery; Human Nutrition; Integration of Agricultural Systems; and Agricultural Information and Library Services. The research carried out under these program activities are explained in the "Purpose Statement" section of the Explanatory Notes. The selected examples of recent progress are listed herein by REE (Research, Education, and Economics) and ARS Strategic Planning goals.

Current program activities and progress under each research area are outlined below:

REE Goal 1--Through research and education, empower the agricultural system with knowledge that will improve competitiveness in domestic production, processing and marketing.

Current Activities

ARS conducts research designed to generate new knowledge; improve production systems; enhance resource efficiencies; improve processing quality, performance, and value of commodities; and develop technologies to reduce nontarriff agricultural trade barriers. The national needs for scientific agricultural information are met in a timely manner. U.S. agricultural producers and processors have access to current knowledge and technologies. Because trade issues are global, ARS expands collaboration with foreign research institutions. The outcomes are technologies and practices that encourage trade in agricultural products and mitigate nontariff barriers to such commerce.

ARS research accomplishments will strengthen the competitiveness of U.S. agriculture in domestic and export markets. The accomplishments will improve the quality, value, and marketability of U.S. agricultural commodities. The accomplishments include development of: new Pima cotton varieties; a new technology to reduce cotton cultivation costs; new technologies to control postharvest insects; a decision tool for determining wool and lamb production costs; a forage peanut for Gulf Coast pastures that improves calf growth; a machine which improves hay quality by extreme conditioning; and improvements in the commercialization of hypoallergenic guayule latex rubber.

Selected examples of recent progress

First cotton germplasm lines received from Russia. The former U.S.S.R. was one of the world's leading cotton producing nations, and for many years maintained an active program of cotton breeding and improvement. ARS scientists have established working relationships with geneticists in Russia and gained access to their large collection of cotton germplasm. Several thousand accessions of cotton not represented in the U.S. germplasm collection will be received from Russia over the next few years for inclusion in the ARS core collection for use by U.S. geneticists. The first few accessions have already been received, and these lines provide a treasure trove of new genes for use by geneticists to improve cotton yield, fiber quality, and disease and pest resistance. (Plant Sciences)

Hypoallergenic guayule latex rubber closer to commercialization. Latex rubber, primarily from rubber trees, induces severe allergic reactions in increasing numbers of people. Several years ago, ARS discovered hypoallergenic latex rubber from guayule, a desert shrub of the southwestern U.S. ARS has developed techniques for storage of harvested guayule without loss of the latex. It has also developed more efficient procedures for recovering the latex from leaves, and a laboratory-scale latex extraction process that parallels the proposed scaled-up commercial process. These results will streamline processing that yields purer rubber at less cost, thus making the product more readily available to the millions of people currently at risk of allergic

reactions. The rights have been licensed to a commercial partner. (Commodity Conversion and Delivery)

Patent issued for novel biopesticide used in stored grain and processed cereal products. ARS researchers in Manhattan, Kansas, in cooperation with researchers at Kansas State University, received a U. S. patent for a recombinant chitinase. Chitinase is an enzyme that degrades chitin, a cellular component of the guts and exoskeletons of insects and of the cell walls of fungi. The scientists are working with several biotechnology companies to develop cereal varieties for commercial use that incorporate the chitinase gene. Use of this biopesticide should reduce levels of insect pests and diseases in stored grain and processed cereal products, and increase market quality and longevity of cereal products. (Commodity Conversion and Delivery)

A sweet cherry survey supports new export market. A 1998 sweet cherry packing house survey reveals that conventional packing house practices remove "hitchhiking" insects (arthropods). The ARS Laboratory in Yakima, Washington examined sweet cherries coming out of the field from 30 growing regions after the cherries had been prepared for packing. Only one "hitchhiking" insect was found in 2400 samples. This information supports the systems approach, that is, the combination of commercial practices used in production, harvesting, packing, and distribution which cumulatively meet the requirements for quarantine security. Using this information, the Pacific Northwest sweet cherry packing industry is considering shipping sweet cherries to Australia, a new market. (Commodity Conversion and Delivery)

Development of "expert systems" to aid peanut producers in making decisions about production and marketing. Peanut production and marketing involve quick complex decision making. ARS scientists and engineers at Dawson, Georgia have developed decision-support systems that can assist farmers in making better decisions about peanut production and marketing. The first system, EXNUT, relies on data from the field to improve irrigation. A second system, MNUT, helps farmers make sound marketing decisions based on records that farmers usually keep such as crop rotation history, peanut variety, water records, soil temperatures, and fruiting initiation date. These peanut production and marketing programs will run on computers with MS Windows that will help farmers make better decisions for producing and marketing their crop. (Integration of Agricultural Sciences)

New Cotton cultivation technology reduces costs. Cotton production is not profitable when prices are low as they have been for the past few years. Growers need to reduce the cost of production by at least five cents per pound of harvested lint. ARS has helped develop a cultivator-shredder which combines multiple operations on a single pass through the field. The reduced use of equipment and fuel can provide savings of up to four cents per pound in California cotton production systems. (Integration of Agricultural Sciences)

New computer simulation model of cotton production. For many years, crop consultants and growers have needed a computer simulation model of the cotton crop. ARS has released and supported *Gossym-Comax* for this purpose, but the model has not been as widely adopted as originally hoped. A new model has been written for validation and user testing in 1999. It will be more widely applicable across the Cotton Belt and require fewer inputs of data from the farmer in order to function properly. The model is intended not only as a decision aid, but also as an adjunct to precision agriculture technology. In the future, the model should be able to predict yield variability from maps of soil and environmental differences. (Integration of Agricultural Sciences)

Forage peanut shows promise in improving calf performance. Tropical grasses are nutritionally inadequate to support acceptable growth rates of beef calves in the Gulf Coast region. Creep grazing (a technique that excludes the cow) on rhizome peanut forage gives nursing calves access to high quality forage. Grazing trials conducted by ARS scientists at the Subtropical Agricultural Research Station in Brooksville, Florida showed calf gains at 25 percent higher than from grazing tropical grass alone. The benefit of creep grazing on rhizome peanut forage helps ranchers to grow heavier weight calves and maintain the brood cows in better condition because of the reduced lactational demand in late summer. (Animal Sciences)

Process for extreme conditioning of forages moves closer to commercial development. Humid or rainy climatic conditions in the Midwest and Eastern regions of the U.S. during May, June, and July often delay forage harvesting, resulting in poor quality forage. Research at the ARS U.S. Dairy Forage Research Center, Madison, Wisconsin has demonstrated that maceration or severe conditioning of forage stems increases the rate of field drying, increases digestibility of the forage, and results in increased milk production. This research has led to a cooperative research and development agreement with a major U.S. manufacturer of farm equipment for development of farm scale prototype equipment. Extensive feeding trials using macerated forage are now in progress. Adoption of extreme conditioning of forages by American farmers would result in a 10 to 20 percent increase in the utilization of forages by dairy cattle. (Commodity Conversion and Delivery)

First method developed for determining lamb and wool production costs. ARS scientists at Dubois, Idaho, in collaboration with the American Sheep Industry Association, have developed a biologically-based procedure which can be used to partition lamb and wool production costs for the sheep enterprise. The work comes at a critical time for the Nation's sheep industry as producers struggle with how much emphasis to place on lamb or wool production. The method developed was tested for different sheep breeds, management systems, and nutrition levels for each of five geographic regions of the U.S. This procedure will enable producers to make independent decisions concerning the emphasis they place upon the lamb or wool enterprise. The procedure can also be used to evaluate potential changes in a sheep operation and the financial impacts. The procedure was made available to the American Sheep Industry Association and to sheep producers in 1998. (Animal Sciences)

A new approach to transgenic animal bioreactors. The animal bioreactor industry will have pharmaceuticals on the market within the next two years that have been produced in the mammary glands of genetically-engineered animals. However, the industry has discovered that isolating the products from milk is the most costly step in the production process. ARS scientists at Beltsville, Maryland, in collaboration with investigators at New York University, have produced the first animal bioreactors that produce drugs in urinary bladders. Drug extraction from urine, a less complex fluid than milk, should be more effective since products can be harvested from both males and females from the time of birth. (Animal Sciences)

REE Goal 2--To ensure an adequate food supply and improved detection, surveillance, prevention and educational programs for the American public's health, safety, and well-being.

Current Activities

ARS conducts research to ensure a secure agricultural production system that reduces or eliminates factors that threaten the ability of U.S. agriculture to produce enough food to meet the needs of American consumers. ARS' research is designed to generate knowledge regarding new and improved management practices, pest management strategies, sustainable production systems, and control of potential contaminants. Food safety research seeks ways to assess and control potentially harmful food contaminants. These activities ensure a safe, plentiful, diverse, and affordable supply of food, fiber, and other agricultural products.

ARS' research accomplishments will increase food safety and help ensure a plentiful and affordable supply of food. The accomplishments include the development of: a treatment based on nontoxic bacteria to reduce salmonella in poultry broilers; an air purifying treatment to reduce salmonella in poultry production facilities; a method to reduce adhesion of bacteria to inanimate surfaces in meat processing plants; a new vaccine to reduce *staphylococcus aureus mastitis* in dairy cows; and vaccines that protect poultry against avian influenza. ARS researchers have also developed various biological controls which address problems such as new DNA markers associated with scab resistance in wheat; a new soybean line that naturally resists insects and has high protein; and gamma irradiation as an alternative to methyl bromide to eliminate blueberry maggots in blueberries.

Selected examples of recent progress

New DNA markers associated with scab resistance in wheat identified. Recent epidemics of Fusarium head blight (scab) in the U.S. have caused devastating yield and quality losses in wheat. Breeding for scab resistance in wheat has always been difficult because of the lack of fast, reliable methods to screen plants. For the first time, researchers at the ARS Wheat Genetics Unit, Pullman, Washington have discovered a DNA marker reliably linked to scab resistance in two separate wheat populations. This new DNA marker is a promising candidate for use in breeding for scab resistance. (Plant Sciences)

ARS scientists discover that crop plants emit chemical distress signals specific to the caterpillar pest attacking them. By emitting chemical distress signals, some corn, cotton, and other field crop plants can summon parasitic wasps to rescue them from feeding caterpillars, such as the corn earworm/cotton bollworm and the tobacco budworm. Breeding crop varieties specifically for production of these chemical distress signals is of great interest to scientists. The research finding, discovered by ARS scientists in Tifton, Georgia and Gainesville, Florida could improve the use of insect enemies. (Plant Sciences)

Area wide pest management of corn rootworm in America's corn belt continues to reap benefits. Corn rootworms are the targets of almost half of the insecticides used in row crops. ARS' 5-year area wide program in the Midwest, using an adult corn rootworm attract and kill technology, has yielded corn rootworm reductions of more than 60 percent in the test sites after two years. A number of corn growers have expressed interest in undertaking their own programs using this new technology. (Plant Sciences)

Disease-causing fungus thwarted by using one of its own genes. *Cercospora* fungi cause serious plant diseases of many crops, including purple seed of soybean and gray leaf spot of corn. As part of the disease process, a toxin produced by the fungus attacks the plant. The fungus is unaffected because it has a molecular "pump" that rids fungal cells of the toxin as it is being produced. ARS scientists at Raleigh, North Carolina have found that by transferring the gene for this "pump" from *Cercospora* to tobacco plants, dramatic increases in resistance to attacks by *Cercospora* occur. This discovery offers a new way to help control *Cercospora* diseases in many crops. (Plant Sciences)

New formulations for microbial pesticides. Pesticides based on microbes, such as bacteria, viruses and fungi offer potential alternatives to chemicals. Microbial pesticides, however, are often less effective than chemicals, in part due to their lack of residual activity in the field. ARS scientists in Peoria have developed novel formulations based on surplus agricultural commodities that can extend the residual activity of microbial pesticides, thus making them more effective under field conditions. Acceptance of these formulations by industry (license negotiations are ongoing) could lead to a wider use of microbial pesticides and reduce dependence on chemicals. (Plant Sciences)

A new soybean line naturally resists leaf-eating insects and has high protein. Insects cause more than $40 million in losses annually to U.S. soybean producers. Increasing the plant's natural defense against insects is an environmentally friendly method for controlling insect damage. The first step for developing new varieties is to identify germplasm lines containing genes for insect resistance. ARS researchers at Urbana, Illinois identified a new line that gives breeders more options for developing insect-resistant, high-protein soybean varieties for farmers. Besides insect resistance, the new line contains 44 percent protein. Previously, the most widely used source of insect resistance offered only 38 percent protein. Soybean breeders interested in developing insect-resistant, high-protein varieties now have another, more desirable parent plant for this purpose. (Plant Sciences)

Reduction of aflatoxin contamination of cottonseed. The soil-borne plant pathogenic fungus, *Aspergillus flavus*, produces a highly carcinogenic toxin called aflatoxin. Crops that are contaminated with aflatoxin are of low value. ARS has identified nontoxigenic *A. flavus* fungal strain that out competed toxigenic *A. flavus* that resulted in reduced toxin synthesis in large demonstration plots of cotton in Arizona. The Arizona Cotton

Research and Protection Council is building a facility to mass produce inoculum to suppress aflatoxin. They expect to be able to treat 20,000 acres in 1999 and 200,000 acres in 2000 with this ARS-developed technology. Reduction of aflatoxin levels to below regulatory limits will greatly decrease the risks in the animal feed supply (the cottonseed meal is fed to dairy cattle which passes the toxin into the milk) and potentially increase a farmer's profits. (Commodity Conversion and Delivery)

Early detection of fruit flies with a novel trap protects U.S. fruit and vegetable export. The Mediterranean fruit fly and the Mexican fruit fly are pests of major economic importance that continue to threaten U.S. fruit and vegetable production and exports. It is critical that sensitive detection systems are developed for these species. ARS scientists in Gainesville, Florida have developed a new fruit fly trap based on natural lures that is highly specific in the capture of economically important pest fruit flies. APHIS and State action agencies in Florida, Texas, Arizona, California and Hawaii are conducting final evaluation of lures in their detection programs. The joint U.S./USDA, Mexico and Guatemala Mediterranean fruit fly program (MOSCAMED) are using the synthetic lures in monitoring for fruit flies in Guatemala and Mexico. (Commodity Conversion and Delivery)

Quarantine treatment for five cultivars of apples. A final research report documents the quarantine security of the two-component treatment against codling moth eggs and larvae in five apple cultivars intended for export to Japan. Research was completed with Braeburn, Fuji, Gala, Granny Smith, and Jonagold apple cultivars on the comparative efficacy of long-term cold storage against codling moth eggs and methyl bromide fumigation against codling moth larvae. There were no statistical differences in efficacy between these cultivars and Delicious apples. In the confirmatory test for the quarantine treatment of the five apple cultivars, the cold storage component was efficacious against codling moth eggs, and the cold storage-methyl bromide fumigation component was efficacious against codling moth larvae. (Commodity Conversion and Delivery)

Hot water dip for limes to prevent foreign pest mealybugs from entering the United States. New commodity treatments are needed to prevent insects, such as the pink mealybug, from entering the United States on imported produce. ARS researchers at Miami have determined that immersing limes for 20 minutes in water at 120°F kills all stages of the mealybugs. In addition to providing the necessary quarantine security, this treatment does not reduce the quality of the limes. This is an example of technology that will allow continued shipment of high quality produce without barriers to trade while preventing new destructive pests from entering the United States. (Commodity Conversion and Delivery)

Near infrared (NIR) spectrophotometry of wheat kernels detects hidden insects. Larval and pupal stages of the major insect pests of stored grain including rice and maize weevils, lesser grain borers, and Angoumois grain moths, develop within grain kernels during storage and are extremely difficult to detect. ARS researchers in Manhattan, Kansas have demonstrated that these hidden insects can be rapidly and accurately detected with NIR technology that can be easily adapted to automated grain handling systems. Subsequent research has indicated that NIR also could be used to identify adult insects and differentiate between parasitized and unparasitized insects. Additional applications of this unique technology to grain and other commodities during storage are being evaluated. (Commodity Conversion and Delivery)

Cold storage quarantine treatment for apples. Mexico requires that apples from the United States be stored for 90 days at 3.3°C before entry to eliminate possible infestation by the oriental fruit moth and the apple maggot. To demonstrate the efficacy of this quarantine treatment, a cooperative study was conducted by the ARS Laboratory in Wapato, Washington on the oriental fruit moth, and the ARS Laboratory in Weslaco, Texas on the apple maggot. All oriental fruit moth eggs and larvae were eliminated by the ninth week of storage, and all apple maggot eggs and larvae were eliminated by the eighth week of storage. (Commodity Conversion and Delivery)

Gamma irradiation is a good alternative to methyl bromide fumigation for eliminating blueberry maggots in blueberries. Blueberry maggots infest lowbush and highbush blueberries grown in the United States and Canada. Fruit grown where the pest is present cannot be shipped to several domestic and foreign markets

unless it has first been treated with an approved quarantine treatment, such as fumigation with methyl bromide. This gas, however, depletes the stratospheric ozone, and its production and use will be restricted in 2005. ARS researchers in Miami discovered that a low dose of irradiation (88 grays) arrested development of the maggot without harming fruit quality. Irradiation is an acceptable quarantine treatment and an alternative treatment to fumigation with methyl bromide. (Commodity Conversion and Delivery)

Development of an "in shipment" controlled atmosphere/temperature treatment as a quarantine treatment against fruit flies and postharvest diseases of citrus. Postharvest diseases cause significant losses and reduce the shelf life of fresh citrus. Also, fruit flies are a major quarantine pest in tropical regions worldwide. ARS scientists in the Crop Quality and Fruit Insect Research Unit in Weslaco, Texas, in cooperation with TransFRESH Corporation, have applied for a U.S. and international patent for a treatment that uses controlled mixtures of gases to treat citrus fruits. The process can be used during shipment of citrus, which takes 15-21 days to reach some overseas markets. ARS scientists determined the ranges of temperatures and atmospheric components that inhibit growth of postharvest fungal diseases, such as blue mold, and kills immature Mexican fruit flies while at the same time maintaining the flavor and appearance of grapefruit. (Commodity Conversion and Delivery)

Competitive exclusion cultures to control Salmonella on commercial broiler farms. ARS scientists at the Food Animal Research Protection Laboratory in College Station, Texas have developed a product called PREEMPT™ which significantly reduces potential salmonella contamination in chickens. The new product preempts the growth of salmonella in the intestines of the newly hatched broiler chicks by introducing a blend of 29 live, nonharmful bacteria naturally present in healthy adult chickens. The newly developed mixture can be sprayed in a mist over newly hatched chicks to give them the same level of salmonella resistance that develops later in older birds.

PREEMPT™ is the successful result of a public-private partnership. ARS scientists worked with MS Bioscience of Dundee, Illinois to develop PREEMPT™, and in March 1998, the FDA approved the Competitive Exclusion Cultures (CEC) for use in commercially produced broiler chickens. PREEMPT™ is the first CEC to receive FDA approval for use in commercial poultry flocks, and it is a major milestone in an integrated program to prevent Salmonella contamination in food products from poultry. (Animal Sciences)

Reduction of salmonella transmission. Airborne transmission of salmonella has gained considerable recognition as an important mechanism by which the pathogen is spread within poultry houses. Reducing Salmonella levels in the air is crucial for several reasons. Laying hens undergoing forced molt by withholding feed are acutely susceptible to infection. Airborne Salmonella can be a source of infection for birds during this period of high stress. Chicks are also highly susceptible to infection shortly after hatching. ARS scientists at the Southeast Poultry Research Laboratory in Athens, Georgia have found that electrostatic ionization of the air in an area housing Salmonella infected adult birds significantly reduces the number of airborne Salmonella in the environment. Similarly, airborne bacteria can also be reduced in hatching cabinets where an electrostatic space charger is used. These findings are fundamentally important since they address one of the critical control points identified in the Salmonella Risk Assessment document recently published by the USDA. Further, this technology is simple, cost effective, and has the added benefit of also reducing dust levels within a poultry house providing significant health benefits for exposed employees. (Animal Sciences)

Treating surfaces to resist pathogens. New methods are being devised to determine the efficacy of material treatments to render inanimate surfaces in the processing areas more resistant to bacterial contamination and biofilm formation. ARS scientists at the Richard Russell Research Center, Athens, Georgia, tested various physical and electrochemical treatments of stainless steel, including methods of sanding, grinding, and polishing, to determine which method best inhibited bacterial attachment and biofilm formation. After treatment, each of the surfaces was less susceptible to bacterial attachment than untreated stainless steel. Stainless steel samples that had been electropolished showed significantly fewer bacterial cells and initial biofilm formations than all others tested. These findings will aid equipment manufacturers in selecting

materials to be used in the food industry that are not conducive to pathogen growth. (Commodity Conversion and Delivery)

Color of cooked beef patties and the food safety risk. A premature brown color in beef patties cooked at less than safe temperatures has been known to present a potential food safety risk. To more completely delineate when color gives false information, ARS scientists at the Meat Science Research Laboratory in Beltsville, Maryland collaborated with USDA Food Safety and Inspection Service (FSIS) laboratories to conduct a nationwide evaluation. The result showed that color in cooked patties changes very quickly and is often not equally distributed within a patty. In raw ground beef, considerable variation can exist between the product surface and interior. Considerable variation in internal temperature can also exist within patties during cooking. Thawed ground beef produces more brown color when cooked than patties cooked from fresh or rapidly thawed meat. The observations provided solid evidence that cooked ground beef patty color is not a good indicator of internal patty temperature. The results were a major factor in the development of the new FSIS consumers' message that consumers should not eat ground beef patties that are pink or red in the middle unless a food thermometer has been used to verify the cooked temperature. (Commodity Conversion and Delivery)

Determining the mechanism of resistance of Southern cattle ticks from Mexico to pyrethroid pesticides helps in the development of new methods to detect and manage pesticide-resistant ticks. Southern cattle ticks in Mexico have evolved high degrees of resistance to the pyrethroid pesticides used widely in Mexico to control these important parasites of cattle. Recent research using strains of pyrethroid-resistant ticks from Mexico demonstrated two distinct mechanisms of resistance in different tick strains. One strain exhibited an enhanced ability to metabolize pyrethroids with esterase and cytochrome P-450 enzymes. In two other tick strains there is evidence that the sodium channels of the resistant ticks are not affected adversely by pyrethroid pesticides or by DDT as they are in ticks that are susceptible to these chemicals. This information can be used in developing resistance management strategies and in research to develop sensitive biochemical methods for detecting and characterizing resistance in Southern cattle tick to pesticides. (Animal Sciences)

A gel vaccine delivery system has been shown to effectively control avian coccidia and reduce the need for drugs in the poultry industry. Infection by avian coccidia poses a major constraint on the poultry industry, accounting for losses in productivity and the need for drugs to control the disease. ARS scientists at the Parasite Biology and Epidemiology Laboratory in Beltsville, Maryland have used a customized live vaccine to protect birds from losses due to coccidiosis and have shown that bird performance is comparable to birds which are drug treated. So far, more than 60 million birds have been treated using this ARS technology. This breakthrough is a major contribution toward eliminating the need for chemicals in production of poultry. (Animal Sciences)

Vaccine for the prevention of *staphylococcus aureus mastitis*. Annual losses due to mastitis in dairy cattle are estimated at $2 billion. *Staphylococcus aureus* results in the greatest losses due to mastitis. Antibiotics are increasingly ineffective, due to the appearance of resistant strains of the organism. Also, antibiotics and other drugs and chemicals used to combat these organisms is one of the greatest threats to food safety. To avoid the use of antibiotics and drugs, scientists have attempted to develop vaccines against mastitis pathogens, but they have met with limited success. ARS scientists at Beltsville, Maryland found that the strains of *staphylococcus aureus* used to formulate the vaccines represent are only 40 percent of the strains present in the national herd. Scientists have isolated a strain of *staphylococcus aureus* which encompasses the other 60 percent, resulting in a vaccine with the potential for producing an effective immune response against all *staphylococcus aureus* strains presently in the national dairy herd. A vaccine delivery system has also been developed that produces a strong, long lasting immune response from a single injection of the vaccine. This vaccine is currently being tested in the laboratory and will be field tested in the near future. With few modifications, it could also be used in other species with the potential of greatly minimizing the contamination of the food chain. (Animal Sciences)

Control of weanling pigs' appetite. A Piglet's feed intake is a major factor in growth and efficiency. A variety of hormones affect the appetite. Potent regulators include neuropeptide-Y, leptin (an obesity gene product) and the newly discovered orexins (orexin-A, and -B). As a critical first step in understanding feed intake, ARS scientists in Columbia, Missouri were the first to clone the genes for a number of appetite-controlling hormones and their receptors in livestock species. This new knowledge of the pig orexin gene sequence made it possible to synthesize porcine orexin-B, for injection into weanling pigs to increase feed intake. The ability to stimulate appetite during critical periods of early growth, particularly following weaning, will improve swine production efficiency. (Animal Sciences)

REE Goal 3--A Healthy and well-nourished population who have knowledge, desire, and means to make health promoting choices.

Current Activities

ARS conducts human nutrition research that establishes the relationship between diet and health, measures food consumption patterns, and develops new methods to measure the nutrient composition of food. The outcomes of these efforts are a safe, and nutritious food supply, and a knowledge base that enables humans to make healthful food choices.

ARS' research accomplishments will lead ultimately to a reduction in the incidence of nutritionally-related diseases and to a more healthy and productive population. The current accomplishments include findings such as: girls must increase calcium intake at an earlier age; natural oil from certain strains of algae can provide the cardiovascular protective effects attributable to fish oil; Nutrim, an oat-based fat substitute may contribute to a healthier diet; and copper in the diet during pregnancy may be important in a child's neural development. A program to build a data base for the nutrients in 1,000 key foods has also been developed.

Selected examples of recent progress

Girls must increase their calcium intakes at the earliest onset of puberty, rather than previously accepted ages. Most of the calcium found in the body is in teeth and bone. The remaining small percent plays a role in mediating vascular constriction and vasodilation, muscle contraction, nerve transmission and glandular secretion. Calcium reference intake values must be set at levels associated with maximum retention of body calcium. Researchers at the Children's Nutrition Research Center at Baylor College of Medicine have determined that girls must increase their calcium intakes at the earliest onset of puberty, rather than previously accepted ages, since peak mineral accumulation occurs at an early age. These findings were translated into the latest recommendations of the National Academy of Sciences Institute of Medicine report. (Human Nutrition)

Continuing Study of Food Intakes by Individuals (CSFII). The final year of data collection for the 1994-96 CSFII was completed by the Beltsville Human Nutrition Research Center. The entire survey was released on CD-ROM in April 1998. The CSFII is a major part of this country's nutrition monitoring effort. Data are used to monitor the nutritional adequacy of U.S. diets; measure the impact of food fortification on nutrient intakes; develop dietary guidance and related nutritional education programs; estimate exposure of population groups to food contaminants; evaluate the nutritional impact of food assistance programs; and assess the demand for agricultural products. In order to meet the needs of the EPA for information required by the Food Quality Protection Act of 1996, the Supplemental Survey was begun in December 1997 and will end December 1998. This data will be added to the CSFII 1994-96 and used to determine exposure of children to pesticides in foods. (Human Nutrition)

Nutrim, an oat-based fat substitute that may contribute to a healthier diet for some people, is the latest food additive developed. Nutrim is rich in beta-glucans, a soluble gum found in oats and barley which has been shown to lower cholesterol in some people when eaten in the right proportions in a low fat diet. Along with

the health benefits, Nutrim contributes important functional properties in foods, such as moistness, softness and cohesiveness in baked foods. Nutrim can also replace dairy products in baked goods, salad dressings, sauces, and ice cream. Made from oat bran, the process for preparing Nutrim is simple and inexpensive. Nutrim ($1.75 per pound) is more cost-effective for food ingredient makers and food manufacturers who utilize oat-based fat substitutes in their products ($3.00 per pound). A patent application has been filed and licenses for the technology are available. (Human Nutrition)

Development of new sunflower lines with healthier oil in their seeds. The public is increasingly demanding healthier foods. This includes greater use of monounsaturated oils. ARS researchers at Fargo, North Dakota genetically revamped an already healthy oil by developing improved sunflower lines with higher levels of monounsaturated oil. These have been used by industry to develop new commercial varieties, termed NuSun, with high monounsaturated oil and less saturated oil. NuSun contains 65 percent monounsaturated oils compared to 20 percent in traditional sunflowers. Additionally, it is 20 percent lower in saturated oil than already low traditional sunflower oil, and it needs no hydrogenation, which eliminates any concern over transfatty acids in prepared foods. It has a pleasing flavor and aroma and extended shelf life. During the growing season of 1989, more than 100,000 acres of NuSun sunflowers were grown, and by 1999 it is expected that most of the three million acres of U.S. sunflower production will be converted to the new variety. This transformation is the most significant development in the sunflower industry since the introduction of hybrid sunflowers in the 1970s. (Human Nutrition)

Supplementing the diet with docosahexaenoic acid may promote cardiovascular health without adverse effects. Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) are long chain, polyunsaturated fatty acids found in fish and fish oils. Since studies on the health of Greenland Eskimos in the 1970s, these compounds have been assumed to have many health benefits when included in one's diet on a regular basis. The Eskimos eat large amounts of DHA and EPA in their diets. Research has been aimed at learning which compound, alone or in combination, is the major contributor to the health benefits claimed for fish or fish oil. Recently, a natural oil made from selected strains of algae has become available that contains DHA, but not EPA. ARS scientists at the Western Human Nutrition Research Center in San Francisco examined its dietary effects on human volunteers. They found that DHA will lower plasma triglycerides similarly to fish oils. High levels of triglycerides in plasma have been linked to increased risk of cardiovascular disease. Besides lowering the triglyceride levels in the volunteers' plasma, dietary DHA appeared to raise the plasma levels of high density lipoprotein cholesterol (HDL-C). Increased HDL-C levels have been shown to protect individuals against heart disease. (Human Nutrition)

Feasibility study indicates that reliable 24-hour dietary intake recall data can be collected by telephone. The Lower Mississippi Delta Nutrition Intervention Research Initiative (Delta NIRI) conducted the Foods of Our Delta Survey (FOODS). Adults and children in households with telephones and in households without telephones were interviewed to determine if telephones could be used to obtain accurate 24-hour dietary intake recall data. Results indicated there were no significant differences between telephone and in person interviews. These findings support research currently underway on using the telephone to collect dietary data in the next USDA Continuing Survey of Food Intakes by Individuals. (Human Nutrition)

The critical role of copper elucidated during pregnancy. Copper deficiency can lead to anemia, low white blood cell count, bone loss, poor growth, and some forms of heart disease. ARS researchers at the Grand Forks Human Nutrition Research Center have identified a link between copper deficiency during pregnancy and neurological defects in the offspring of laboratory animals. Scientists fed mice diets lacking adequate copper throughout pregnancy and for a few weeks after delivery. They observed enzyme levels in the brains of pups and changes in protein kinase C, an enzyme involved in the development of the nervous system. These findings may have implications for human mothers by showing the importance of an adequate copper intake during pregnancy. (Human Nutrition)

New margarines produced with trans fatty acids evolved from ARS research. Researchers at the Beltsville Human Nutrition Research Center examined the effects of butter and two margarines on blood lipids of volunteers in a study. Study subjects consuming margarine containing trans fatty acids had lower total cholesterol and low density lipoproteins compared to butter intakes. Results from this study were published in the October 1998 American Journal of Clinical Nutrition. Findings from this study have been useful in the development and use of margarines with trans fatty acids. (Human Nutrition)

ARS in conjunction with the NIH has developed the National Food and Nutrient Analysis Program (NFNAP). Scientists at the Beltsville Human Nutrition Research Center have conducted research to statistically design, sample and analyze the composition of foods. A nationwide sampling plan was developed. Nutrient analyses were conducted for specific foods and brand name products such as six fat levels of margarine, various ethnic dishes, several soy products, and 13 different teas. Food composition data that reflects current foods consumed is important for assessing their nutritional quality and role in the population's health status. (Human Nutrition)

REE Goal 4--To enhance the quality of the environment through better understanding of and building on agriculture and forestry's complex links with soil, water, air, and biotic resources.

Current Activities

ARS seeks to enhance the quality of the environment through a better understanding of and building on agriculture's complex links with soil, water, air, and biotic resources. The scientific program in natural resources and sustainable agricultural systems conducts multi disciplinary research to solve problems arising from the interaction between agriculture and the environment. New practices and technologies will be developed to conserve the Nation's natural resource base and balance production efficiency and environmental quality. ARS collaborates with foreign research entities to address global environmental problems.

ARS' research accomplishments will increase the productivity of U.S. agriculture while preserving and enhancing the Nation's natural resources. Current accomplishments include: field management practices that reduce sediment and pesticide runoff; wetlands and other buffer zones that are effective at protecting water quality from nitrogen and phosphorus contamination; crop selection guidelines that will help growers conserve water; and management practices that sequester carbon in the soil and reduce greenhouse gas emissions; carbon dioxide levels that mitigate the ozone's damage to crops.

Selected examples of recent progress

Improved detection of cryptosporidium parium in agricultural and environmental samples. Cryptosporidium parium is a protozoan parasite responsible for the emerging disease cryptosporidiosis. The infectious stage of the parasite is excreted in cattle feces, and is pervasive in soil and water areas associated with agricultural usage. Humans can become infected through the ingestion of contaminated food and water, and by using recreational areas, such as swimming pools, ponds, lakes, and municipal fountains. The minute size of the parasite makes detection difficult.

ARS scientists at the Immunology and Disease Resistance Laboratory at Beltsville, Maryland developed a nested polymerase chain reaction (PCR) assay to improve detection of cryptosporidium. Using this assay, samples which had previously been considered to be uninfected were found to harbor cryptosporidium. The samples included water and oyster tissues from the Chesapeake Bay where agricultural runoff is thought to contribute to the presence of pathogenic microorganisms in the environment. The PCR assay is being adapted for use with new, "real-time" instrumentation to improve detection time, and the number of samples needed to be examined. The use of this assay will allow investigators to better determine the role of agricultural practices in the distribution of this parasite in the environment, and allow accurate and sensitive monitoring of control strategies. (Soil, Water, and Air Sciences)

Application of alum to feedlot pens improves the air quality near confined feeding operations. Ammonia emissions from feedlots are a source of disagreeable odors that, in extreme cases, cause health problems. Scientists in Bushland, Texas found that applications of alum to the surface of feedlot pens decrease ammonia emissions from feces and urine by 50-80 percent. The alum also increases the nitrogen content of feedyard manure, making it a more valuable byproduct for use as a fertilizer. Residents near feedlots will enjoy better air quality while producers will benefit from more effective manure-fertilizer for their fields. (Soil, Water, and Air Sciences)

Snowmelt model proves a successful tool for evaluating water supply. Snow is the dominant source of water for downstream uses including irrigated agriculture in much of the interior Pacific Northwest. Snow accumulation and melt is highly dependant on terrain and vegetative cover, making snowmelt modeling difficult. ARS researchers in Boise, Idaho have developed and successfully applied a snowmelt model to the Boise River Basin. The model provides accurate prediction of water produced from snowmelt, and its availability downstream. Accurate prediction is essential for optimum water resource management, benefitting administrators of delivery systems as well as producers using irrigation services.
(Soil, Water, and Air Sciences)

Center Pivot Evaluation and Design (CPED) provides a low cost and effective way of evaluating center pivot sprinkler irrigation performance. For water to be applied efficiently, it needs to be applied uniformly across a field. Researchers in Fort Collins, Colorado have developed the CPED program as a cost efficient way to evaluate the uniformity of new and modified center pivot sprinkler irrigation systems. This is an attractive alternative to using catch cans which have inherent errors and are time consuming to use. The Natural Resources Conservation Service is already using the CPED program to evaluate center pivot designs under the Environmental Quality Incentives Program. Farmers and irrigation companies will benefit from the program. (Soil, Water, and Air Sciences)

Constructed wetlands are effective at protecting water from nitrogen contamination near fields treated with swine manure. Swine manure is costly and disposal is difficult. If it is applied to fields, it can run off and cause nitrogen contamination in neighboring water sources. ARS scientists in Florence, South Carolina have successfully used constructed wetlands to protect water sources. The wetlands remove more than 80 percent of the nitrogen runoff from adjacent fields treated with swine manure. This benefits producers seeking a sustainable system for using swine waste, and it benefits water users by mitigating the amount of nitrogen entering water supplies. (Soil, Water, and Air Sciences)

Forested wetland riparian areas stop pesticides and nutrients from reaching neighboring water supplies. Agriculture is the leading source of damage to the Nation's rivers and lakes, affecting 60 percent of the impaired river miles and 50 percent of impaired lake acres. ARS researchers in Oxford, Mississippi recognized that control technologies to keep nutrients and pesticides from running off into neighboring water supplies were cost prohibitive or nonexistent. They investigated the capability of natural forested wetland riparian areas to trap pesticides and nutrients and found that 99 percent of pesticides and 73 to 87 percent of the nutrients were trapped in the buffer. These findings demonstrate the benefit of natural buffers for producers as an inexpensive way to mitigate agriculture's effect on the environment. (Soil, Water, and Air Sciences)

Conservation tillage using a reduced input practice is effective in reducing soil loss without a lot of chemicals. Conservation tillage is very effective in reducing soil loss associated with row crop production, but it is not used by some farmers because of concerns with high agrochemical use. ARS scientists in Coshocton, Ohio have developed a reduced input system that replaces purchased chemical inputs with limited tillage, legumes, and manure. This modification of conservation tillage methods benefits farmers looking for more sustainable methods for controlling erosion. Water quality is also improved because less soil is lost from the field. (Soil, Water, and Air Sciences)

Cotton crops using a no-till system and poultry manure yield significantly more cotton than crops using conventional methods. ARS researchers in Watkinsville, Georgia have found that poultry manure increases the productivity of a cotton-rye cropping system, producing 15 to 20 percent more cotton. Systems using poultry manure as a nutrient *and* no-till cropping produce 35 to 45 percent more cotton than conventional till and commercial fertilizer systems. Farmers benefit from a more productive system that is sustainable where they can dispose of and benefit from the poultry manure while minimizing the effect on the environment with a no-till system. A use for poultry manure would provide an economically and environmentally sound way to recycle the nutrients found in the manure. (Soil, Water, and Air Sciences)

A new assessment tool targets agricultural watersheds most vulnerable to the loss of phosphorus from fields. Current legislation requires the Natural Resources Conservation Service (NRCS) to develop phosphorus management plans for farmers by the year 2000. Focusing on confined animal feeding operations, the watershed assessment tool developed by ARS researchers in University Park, Pennsylvania helps NRCS and State agencies improve the cost-effectiveness of their nutrient management programs by prioritizing watersheds (or parts of watersheds) on the basis of those most vulnerable to non-point source contamination. This benefits State regulatory agencies, livestock producers, and ultimately water users in areas where expanding animal operations are causing water quality problems. (Soil, Water, and Air Sciences)

A new technique determines the amount of pesticide applied to a field that will not move offsite. Past models of pesticides' effect on the environment over-predicted the movement of pesticides to surface and groundwaters. ARS researchers in St. Paul, Minnesota developed an easy and useful technique to determine the amount of pesticide that is irreversibly bound to soil--the amount that is not available for offsite movement. This technique will help policymakers and scientists to devise systems to reduce the environmental risks associated with pesticide use, and improve the efficacy of pesticides. (Soil, Water, and Air Sciences)

New system allows site-specific recommendations for when and where to spoonfeed nitrogen. Excess nitrogen on a field can run off and contaminate water supplies but nitrogen will stunt a plant's growth. ARS researchers in Fort Collins, Colorado have estimated nitrogen stress in corn by correlating soil nitrogen content with remotely sensed measuring data, of canopy-reflectance that shows the difference in plant growth across the field. This estimation enables site specific recommendations for when and where to feed plants increased amounts of nitrogen. Farmers benefit from lower input costs and healthier plants, while the public benefits from a safer environment. (Soil, Water, and Air Sciences)

Exposure to carbon dioxide reduced most of the detrimental physiological effects associated with elevated levels of ozone. Exposure to ozone reduced leaf photosynthesis, total biomass, and grain yields of winter wheat and soybeans. ARS researchers in Beltsville, Maryland showed that simultaneous exposure to elevated carbon dioxide mitigated most of the detrimental physiological effects associated with elevated ozone. This research indicates that rising carbon dioxide levels may mitigate crop damage from pollutants. The findings provide a better understanding of the impact of ozone and anticipated changes in air chemistry on food production in the next century. (Soil, Water, and Air Sciences)

Improved management of pastures in the Southeast may be one of the most viable options to sequester atmospheric carbon dioxide in the soil as organic carbon while optimizing economic benefits from the land. ARS researchers in Watkinsville, Georgia have shown that coastal bermuda grass sequestered more carbon in soil when grazed intensively by cattle than when harvested for hay or left ungrazed and unharvested. An average of 2000 more pounds of carbon per acre was observed under grazed than under hayed bermuda grass pastures after 15 to 19 years. After 25 years, soil organic carbon was 30 percent greater in a mixed tall fescue-bermuda grass pasture than in a conservation tillage system. Sequestered soil carbon means less carbon dioxide is released into the air as greenhouse gas. (Soil, Water, and Air Sciences)

Grazed rangelands may have significantly greater soil organic carbon levels than ungrazed rangelands. ARS researchers in Cheyenne, Wyoming have shown that rangelands grazed all season at either light or moderate intensities has greater organic carbon in the surface (12 inches) of the soil and also exhibited greater photosynthesis compared to adjacent, nongrazed rangelands. These findings indicate that grazing does not detrimentally affect soil health and in fact demonstrates some positive responses that may enhance carbon sequestration. Nongrazing resulted in a major portion of the carbon in the system being represented by standing dead plant material and litter that is readily oxidized into the atmosphere. (Soil, Water, and Air Sciences)

Transgenic tomato plants containing a gene for a heat shock protein from carrots were shown to be more heat tolerant. ARS researchers in Beltsville, Maryland cloned a tomato heat shock protein gene called DNA J. The clone was used to demonstrate that the more thermotolerant transgenic tomato plants containing the carrot gene are probably more tolerant to heat stress because the carrot gene is causing the tomato plant to produce its own protective proteins, even at normal temperatures. This discovery indicates that it is possible to protect plants from adverse effects of high temperatures by genetic engineering.

In the past, soybeans have shown little response to increased atmospheric carbon dioxide concentrations. ARS scientists in Beltsville, Maryland identified soybean cultivars that have large increases in yield when grown at elevated carbon dioxide levels. This indicates that the potential exists to take advantage of differences among cultivars in their response to increasing atmospheric carbon dioxide to increase yields of soybeans. (Plant Sciences)

Rising atmospheric carbon dioxide levels sometimes reduces water use by plants. Potential consequences of slower transpiration for rangelands are enormous, because both the productivity and plant species comprising the ecosystems are strongly controlled by soil water availability. ARS researchers in Temple, Texas showed that experimental carbon dioxide enrichment reduced rates of soil water depletion during dry seasons of the year in both semi-arid shortgrass prairies in Colorado and wetter grasslands in central Texas. Results indicate that improvements in soil water content will play an important, even dominant, role in explaining the effects of future carbon dioxide concentrations on the structure and function of rangelands and, on the sustainability of livestock production systems on these ecosystems. (Soil, Water, and Air Sciences)

More is known about ultraviolet-B (UV-B) radiation effects on crops. Many questions exist about the potential effects of increased UV-B if stratospheric ozone depletion continues, but little baseline information is available about the effects of current ambient levels of UV-B. Large scale field experiments in Beltsville, Maryland using exclusion filters that selectively block parts of the solar spectrum, have shown that ambient UV-B impacts several aspects of soybean physiology and morphology. The experiments by ARS researchers have shown that the effects may be beneficial in some genetic lines but detrimental in others. Moreover, UV-B effects may depend on other factors such as atmospheric ozone exposure. This information would be useful in breeding crops which are less sensitive to the potential impacts of global change. (Soil, Water, and Air Sciences)

Experiment determines how crop quality will be affected by rising atmospheric carbon dioxide and its interactions with environmental stresses. Research showed that elevated carbon dioxide reduced the percentage of oil in seeds of two soybean lines. Although drought had no impact on oil content at ambient carbon dioxide level, it significantly increased at elevated carbon dioxide levels. Oil quality (i.e., fatty acid composition) was not significantly affected by elevated carbon dioxide, but environmental stress (i.e., drought and ozone exposure) resulted in consistent, small increases in the content of saturated fatty acids compared to unsaturated fatty acids. This information, by ARS researchers in Beltsville, Maryland indicates that interactions between global change effects and existing stresses can be important.
(Soil, Water, and Air Sciences)

Wheat was grown for four seasons at elevated levels of carbon dioxide in an open field using a free-air carbon dioxide enrichment approach. Research has shown that at concentrations of about 550 parts per million, such as those expected near the middle of the next century, wheat grown in Phoenix, Arizona used about 7 percent less water while at the same time growth and yield increased about 20 percent. Besides implying that increased carbon dioxide may compensate for adverse effects of climate change on wheat productivity, these data also suggest that such improved efficiency of water use is likely to allow grasses to survive and grow in more arid regions. (Soil, Water, and Air Sciences)

Ammonia and methane emissions from concentrated swine production facilities are comparable to those reported in Europe and about 25 to 30 percent of EPA estimates for U.S. Studies revealed that anaerobic lagoons in Watkinsville, Georgia did not emit nitrous oxide, however, field applications of effluent resulted in the loss of about 13 percent of applied nitrogen as nitrous oxide. Methane and nitrous oxide are gases implicated in global warming, and ammonia and ammonium aerosols are potential air and water pollutants. These measurements will improve accuracy of estimates of greenhouse gas emissions, and will assist producers, regulatory agencies, and facility designers in minimizing the potential impact of concentrated animal production. (Soil, Water, and Air Sciences)

REE Goal 5--Empower people and communities, through research-based information and education, to address the economic and social challenges of our youth, families, and communities.

Current Activities

ARS conducts research to identify new crops, products, technologies, and practices which increase profitability, expand markets, add value, and make small scale processing capabilities available in rural communities. Access to technologies and information is expanded and simplified so that ranchers and rural residents can obtain information in a timely manner.

ARS' research accomplishments provide economic opportunities to rural communities, and provide agricultural information and technologies to farmers, ranchers and other rural citizens. The accomplishments include: new methods to maintain quality of intact and fresh cut produce; new natural product clays to replace pesticides; techniques to make absorbents from agricultural byproducts; and cultural methods to increase fingerling fish production.

Selected examples of recent progress

Quality maintenance of intact and fresh-cut produce. Natural deterioration and decay are a major concern leading to reduced shelf life of produce. Reduction of deterioration and decay can be accomplished without the use of undesirable chemicals. Methyl jasmonate, a natural compound, was found to protect zucchini squash, sweet peppers, and grapefruit from chilling injury and decay and doubled the shelf life in tests conducted at the ARS Horticultural Crops Quality Laboratory in Beltsville, Maryland. Methyl jasmonate elicits compounds in plants that make them more resistant to temperature changes and attack from insects, bacteria, and fungi. (Plant Sciences)

New natural product clays show promise as substitutes for at-risk pesticides. ARS scientists at Kearneysville, West Virginia have discovered that a natural product derived from kaolin clay possesses high repellency properties against arthropod pests and plant pathogens. Kaolin particles are expected to serve as alternatives to at-risk pesticides. A cooperative research and development agreement has been signed with the Engelhard Corporation, Iselin, New Jersey to develop a commercial product. (Plant Sciences)

New techniques are being developed to make carbonized and noncarbonized absorbents from agricultural by-products, including nutshells, soybean hulls, and sugarcane bagasse. ARS researchers at the Southern Regional Research Center, New Orleans determined that these adsorbents are capable of removing a variety of organic

and inorganic pollutants from industrial, municipal and residential water and wastewater. Standard carbons are typically made from coal, peat, coconut shells, and wood and are used in quantities in excess of 300 million pounds annually in the U.S., 600 million pounds worldwide. About 100 billion pounds of assorted agricultural wastes are generated each year. Nutshells, for example, are currently sold for livestock bedding, mulch or other low value commodities, commanding only $2 to $10 a ton. This technology converts low value, renewable agricultural wastes to high-value added materials, using a waste to clean up other wastes. Many of the granular activated carbons made from nutshells have outperformed commercial carbons in some applications. (Commodity Conversion and Delivery)

Development of the sunshine bass pond culture method greatly increases fingerling production. Sunshine bass fingerling farmers have experienced average survival rates of fish from fry (recently hatched) to fingerling (small) stage averaging only 10 percent and ranging from zero and 70 percent, which is costly for the farmer and limits marketing because of unpredictability of product supplies. After ARS scientists at the Stuttgart National Aquaculture Research Center determined that existing culture methods resulted in fry being stocked at a time when essential zooplankton prey had become too large for the fry to eat and often large enough to eat the fry, a course of zooplankton succession in ponds was then determined. They found that if fry were stocked at 5 days-of-age in ponds that had been fertilized and filled for 5 days, an average survival rate of 60 percent could be achieved, because appropriate size zooplankton would be present in the ponds. Farmers utilizing this method have greatly increased fish survival rates and now have predictable supplies of fingerlings, a situation that is greatly facilitating market expansion. A culture method is being fine tuned now to allow for off-season production of fingerlings. (Animal Sciences)

Evaluation of ozone to improve water quality in catfish hatcheries. In the Mississippi Delta, water clarity in some catfish hatcheries is poor due to the high dissolved organic content of certain aquifers. Researchers at the ARS Catfish Genetics Research Unit in Stoneville, Mississippi evaluated the injection of ozone into catfish hatchery water supplies to improve water quality and increase dissolved oxygen levels. Egg hatching and fry survival rates of fish reared in ozonated waters equaled that of fish reared in untreated water; however, water clarity was improved by 85 percent, fingerling growth rates were higher for fish reared in ozonated water, and dissolved oxygen levels in the tanks receiving ozone/oxygen injection were doubled compared to rearing tanks receiving typical air injection. This technology could also be used to improve water quality in fish hatcheries that utilize surface water. (Animal Sciences)

Use of hydrochloric acid as a feed additive to prevent milk fever in dairy cows. ARS scientists at Ames, Iowa have demonstrated that adding hydrochloric acid to the diet fed to cows shortly before they calve is an effective and palatable means of reducing the incidence of milk fever in dairy cattle, a low blood calcium disorder that affects about 6 percent of dairy cows. Adding hydrochloric acid to the diet counteracts the alkalinizing effect dietary potassium has on blood pH. This technology is easily implemented and is currently being used by farmers and feed manufacturers. (Animal Sciences)

Trees can act as effective traps for agricultural water runoff and still benefit the producer economically. In the past, there was a question about whether farmers could cut and sell the timber in their buffer zones and still maintain the effectiveness of buffers to trap runoff water from fields. ARS researchers in Tifton, Georgia have completed a four year project that measured sediment trappings for buffer zones managed in three different ways: left as a mature forest, clear-cut for timber, and selectively thinned for timber. Significant reductions (95 percent reduction for the mature forest, 74 percent for the clear cut timber, and 68 percent for the selectively thinned timber)in runoff and sediment transport were found under all three forest management treatments. These results have economic and environmental benefits to landowners across the Coastal Plains region, but also for other areas where use of riparian buffers is recommended to maintain water quality. (Soil, Water, and Air Sciences)

Waste byproduct of coal-fired electric generation (flyash) means greater profitability and cleaner milk for dairy farmers. Concrete pavement is a relatively ineffective floor for barnyards and dairy cattle loafing areas. Using

flyash as pavement costs far less than concrete, reduces animal health problems, and improves milk cleanliness. ARS researchers at University Park, Pennsylvania provided the basis for regulatory approval of flyash use. Dairy farmers enjoy greater profitability, and electricity users do not have to absorb the costs of flyash disposal. (Soil, Water, and Air Sciences)

REE Goal 6--Management Initiative--Ensure and enhance worldwide access to agricultural information through the programs of the National Agricultural Library.

Current Activities

Through the programs and services of the National Agricultural Library (NAL), ARS ensures that agricultural information essential to the Nation is acquired, organized, disseminated, and preserved for current and future use and that appropriate advances are made to improve access to such information. NAL's work is related to ARS goals and performance measures in extension, outreach, education, library services and higher education.

In 1998, NAL's accomplishments included: provision of World wide Internet access to AGRICOLA, the NAL bibliographic database; expansion of access to other electronic information resources over the Internet and other USDA networks; and implementation of a program to ensure future availability of USDA digital publications.

Selected examples of recent progress

AGRICOLA database is on the Web. Since its inception in 1972, NAL's AGRICOLA database has been available to the public only through the products of commercial companies. Now NAL is able to offer unlimited access to AGRICOLA's 3.5 million citations over the World Wide Web at no charge to the user. This is a tremendous benefit to researchers and others who need information in any area of agriculture. (Agricultural Information and Library Services)

Access to agriculture information on the Internet is expanded. NAL is coordinating the work of 21 land grant universities and other organizations in the U.S. and Canada to create, expand, and operate the Agriculture Network Information Center (AgNIC). AgNIC is a distributed information network on the Internet that links users with quality sources of information on agriculture and related sciences and social sciences. In 1998, AgNIC moved from prototype to full scale operation with the addition of 16 new institutional members. An organizational "alliance" structure was created for managing the collaborative effort, and a governace document, guidelines for participants, and an executive board were put in place. AgNIC serves as a model for how organizations in other subject disciplines can work together successfully to provide access to information over the Internet. (Agricultural Information and Library Services)

NAL expands access to electronic resources. NAL added a significant core of current scientific literature to the resources available through its Electronic Media Center. Nearly 200 full-text electronic journals are available for use at NAL, including 170 electronic journals published by Academic Press. The Academic Press journals are also available to USDA employees in the Washington metropolitan area. Access to several major database resources in agriculture has been extended to researchers in the Beltsville area. (Agricultural Information and Library Services)

Paper-based records for materials converted to electronic format. A milestone in NAL's efforts to convert to an electronic library was reached in fiscal year 1998 with the completion of a five year project to create searchable catalog records for all monographs in the Library's collection. Previously, the paper-based card catalog records were only available to onsite users at NAL. As a result of this conversion project, records describing 188,000 information resources are now available. Many of the records converted in this project describe unique historically important agricultural books, reports, and other published resources that are held

only in NAL's collection. Online access to the location and holdings information about the Library's collection is the basis for enhancing NAL's rapid delivery of agricultural information to the broadest community of users. (Agricultural Information and Library Services)

Increase in electronic document delivery. NAL continued to encourage patrons to send requests and receive materials electronically. Part of this effort included providing complimentary copies of the Internet-based Ariel software and technical support to over 20 USDA regional offices and the libraries of Historically Black Colleges and Universities, plus Tuskegee. Through Ariel, documents can be sent directly to a user's workstation anywhere in the world in less than a minute. As a result of this effort, initial statistics reported for fiscal year 1998 show that: 80 percent of all document delivery requests were received electronically (a 19 percent increase over fiscal year 1997) and 34 percent of all filled requests were delivered electronically(a 60 percent increase). (Agricultural Information and Library Services)

Digital preservation of USDA publications. In cooperation with USDA's Chief Information Officer (CIO), NAL is taking a lead role in developing a strategy to ensure preservation of USDA publications in electronic form. A report entitled Framework for the Preservation of and Permanent Public Access to USDA Digital Publications was produced during an NAL-hosted stakeholders workshop and was accepted by the CIO for implementation within the Department. As a result, a USDA Digital Publications Preservation Steering Committee has been established that will oversee implementation of the Framework. The steering committee will consider issues related to inventory and life cycle management, technical requirements, and user access and retrieval in order to prevent the irrevocable loss of USDA's electronic publications. NAL also is moving forward with its program to convert brittle paper materials to digital images for both preservation and access. To date, more than 35,000 text and image pages from the Journal of Agricultural Research have been scanned and digitally preserved, and will soon be available through NAL's preservation website.(Agricultural Information and Library Services)

NAL builds and provides access to historical collections. During 1998, NAL led efforts to identify and collect archival materials that document USDA's successful program to eradicate the screwworm, a destructive parasite of cattle. Shipments of materials equaling 74 linear feet have arrived from ARS labs in the U.S. and Mexico. Additional material will be acquired, and researched to prepare an oral history, and a guide to the collection will be developed.

Significant progress has been made in processing the USDA History Collection, which was transferred to NAL in 1997. More than 230 linear feet of the collection have been processed. More than one third of the 13,000 books, reports, and journal issues received as part of the Collection were added to the NAL general collection and a Web-based version of a guide to it was designed. Staff provided access to the collection for research, reference and exhibit purposes during the year. (Agricultural Information and Library Services)

Buildings and Facilities:

For acquisition of land, construction, repair, improvement, extension, alteration, and purchase of fixed equipment or facilities as necessary to carry out the agricultural research programs of the Department of Agriculture, where not otherwise provided, [$56,437,000] $44,500,000, to remain available until expended (7 U.S.C. 2209b): Provided, That funds may be received from any State, other political subdivision, organization, or individual for the purpose of establishing any research facility of the Agricultural Research Service, as authorized by law.

AGRICULTURAL RESEARCH SERVICE
BUILDINGS AND FACILITIES

Current Estimate, 1999	$56,437,000
Budget Estimate, 2000	44,500,000
Decrease in Appropriation	- 11,937,000

SUMMARY OF INCREASES AND DECREASES - CURRENT LAW
(On basis of appropriation)

Facilities	1999 Current Estimate	Changes	2000 Estimate
Arizona: Water Conservation and Western Cotton Laboratory, Maricopa	$500,000	-$500,000	--
California: Western Human Nutrition Research Center, Davis	6,150,000	+2,850,000	$9,000,000
Western Regional Research Center, Albany.	--	+2,600,000	2,600,000
Hawaii: U.S. Pacific Basin Agricultural Research Center	4,500,000	-4,500,000	--
Illinois: National Center for Agricultural Utilization Research, Peoria	8,200,000	-6,400,000	1,800,000
Iowa: National Animal Disease Center, Ames.	2,957,000	-2,957,000	--
Kansas: U.S. Grain Marketing Research Laboratory, Manhattan	1,400,000	-1,400,000	--
Louisiana: Southern Regional Research Center, New Orleans	6,000,000	-500,000	5,500,000
Maryland: Beltsville Human Nutrition Research Center, Beltsville	2,500,000	+10,500,000	13,000,000
National Agricultural Library, Beltsville	1,200,000	-1,200,000	--
Mississippi: Insect Rearing Facility, Stoneville	200,000	-200,000	--
Montana: Pest Quarantine and Integrated Pest Management Facility, Sydney	7,300,000	-7,300,000	--
New Mexico: Jornada Range Research Station, Las Cruces	6,700,000	-6,700,000	--
New York: Plum Island Animal Disease Center, Greenport	3,500,000	+4,700,000	8,200,000
Pennsylvania: Eastern Regional Research Center, Philadelphia	3,300,000	+1,100,000	4,400,000
Utah: Poisonous Plant Laboratory, Logan	30,000	-30,000	--
West Virginia: National Center for Cool and Cold Water Aquaculture, Leetown	2,000,000	-2,000,000	--
Total Available	56,437,000	-11,937,000	44,500,000

PROJECT STATEMENT - CURRENT LAW
(On basis of appropriation)

	1998 Actual	1999 Current Estimate	Increase or Decrease	2000 Estimate
	AMOUNT	AMOUNT		AMOUNT
Total Obligations.....	$47,078,000	$74,782,000	-9,510,000	$ 65,272,000
Unobligated Balances:				
Available Start of Year.....	-68,674,000	-102,226,000	+18,345,000	-83,881,000
Available End of Year.....	102,226,000	83,881,000	-20,772,000	63,109,000
Total Available or Estimate.....	80,630,000	56,437,000	-11,937,000	44,500,000

AGRICULTURAL RESEARCH SERVICE

PROPOSED INCREASES AND DECREASES--BUILDINGS AND FACILITIES

A total request of $44,500,000 for **Buildings and Facilities**, consisting of:

a) An increase of $13,000,000 for modernization of facilities at the **Beltsville Agricultural Research Center**, Beltsville, Maryland.

The Beltsville Agricultural Research Center (BARC) was established in 1910. Current land resources total 6,582 acres and accommodate almost 800 buildings and structures in support of ARS research programs. The programs include Natural Resources and Environmental Sciences, Plant Sciences, Livestock and Poultry Sciences, and Human Nutrition. The ARS staff at Beltsville totals about 1,500 employees including 300 scientists.

BARC is the largest agricultural research center in the world in terms of program scope and concentration of scientists. It has long had a worldwide image of prominence in the agricultural sciences because of its history of research quality, contributions to agriculture, and prominent scientists. In addition, other Federal and State agencies such as the Food and Drug Administration, Environmental Protection Agency, Animal and Plant Health Inspection Service, National Aeronautics and Space Administration, Patuxant Wildlife Research Center, Departments of State and Treasury, and the University of Maryland have offices or laboratories at BARC, or have facilities adjacent to the Center.

Modernization of facilities at BARC which began in FY 1988 is projected to continue through FY 2008 or later, depending on the availability of funding. In FY 1999, $2.5 million was appropriated for construction of a new Poultry Facility and for miscellaneous small projects. Funds are needed in FY 2000 to continue with the implementation of the BARC modernization plan currently projected to cost approximately $205 million.

In FY 2000, ARS proposes $13 million specifically for:

New BHNRC Facilities. A reevaluation of the human studies component of the BHNRC program has resulted in a reduction of planned increased modernized space. BHNRC's needs can best be met with both a new 70,000 g.s.f. building, and by gutting and rebuilding Building 307 to provide a facility totaling 137,120 g.s.f.

The renovation of Building 307 is estimated to cost $13.5 million. In FY 1997, $1.7 million was appropriated to begin the design of the new building addition. Construction costs for the new BHNRC building addition are estimated at $22.2 million over two phases. In FY 2000, ARS is requesting $11.4 million to construct the first phase of the new facility addition. The first phase will accommodate the Human Studies Dietary Facility including Calorimetry as well as some laboratory space for the Diet and Human Performance Laboratory.

Miscellaneous Small Projects/Contingency. In FY 2000, ARS is requesting $1.6 million for small projects and contingencies. The small projects scheduled for FY 2000 include demolition of facilities and minor renovations of some others. In addition, ARS is setting aside a contingency fund to cover unforeseen developments during design and construction of other modernization projects, as well as a source of funding to cover future major modernization projects where costs exceed available funds in that fiscal year.

b) An increase of $14,300,000 for modernization of facilities at the **ARS Regional Research Centers**: Albany, California ($2.6 million); Peoria, Illinois ($1.8 million) Philadelphia, Pennsylvania ($4.4 million); and New Orleans, Louisiana ($5.5 million).

Facilities constructed in the late 1930s are hampering ARS scientists from carrying out advanced research since methodology, technology, and approaches have significantly changed over the last half century. Additional resources are needed to renovate and modernize all four major national research centers. The investment is essential for these research Centers to regain the scientific capacity necessary to make discoveries that will contribute to development of new agricultural markets at home and abroad.

Due to the age of the regional research centers, all major building systems--heating, ventilation, air-conditioning, electrical, roofs, and infrastructures (paving, steam and water lines, and waste treatment disposal systems)--have either reached or passed their useful life expectancy. Other existing deficiencies involving safety and health needs, such as fume hood upgrades, single pass air, and building code upgrade requirements, need to be corrected.

Additional appropriations are required in FY 2000 to enable ARS to proceed with the phased modernization efforts at the Western Regional Research Center (WRRC), Albany, California; National Center for Agricultural Utilization Research (NCAUR), Peoria, Illinois; Eastern Regional Research Center (ERRC), Philadelphia, Pennsylvania; and Southern Regional Research Center (SRRC), New Orleans, Louisiana. Since ARS has virtually no swing space to house displaced scientists, phased construction of major renovations of major laboratories is necessary while individual laboratories or wings of laboratories are being renovated. The major needs for these Centers in FY 2000 are as follows:

WRRC Modernization. The Research and Development Facility (RDF) is used to conduct industrial, food, and biological processing research and advanced manufacturing technology development at WRRC. It plays a critical role in the Center's research program.

Since the original construction of the Center in the 1940s, very little renovation has occurred. As a result, room arrangements; interior finishes; and mechanical , plumbing, and electrical systems have deteriorated and are no longer capable of supporting existing and future research programs.

In FY 1995, a construction contract was awarded using $800,000 of Agency funds to upgrade the "building envelope" of the RDF. In 1997, requirements for the modernization of the building interior were developed using $180,000 of Agency funds.

The estimated design and construction costs for the entire project (five phases over nine years) is $22.2 million. The construction costs of the five phases is estimated to be $19.6 million (i.e., phase 1, $4.9 million; phase 2, $3.8 million; phase 3, $2.3 million; phase 4, $5.4 million; and phase 5, $3.2 million). In FY 2000, ARS is requesting $2.6 million for design of all phases.

NCAUR Modernization. The total planning, design, and construction cost is estimated to be $23.1 million for modernization of the Chemical Wing. This includes $5.9 million for phase 1, $7.4 million for phase 2, and $8 million for phase 3. In FY 2000, $1.8 million is requested for design of the Chemical Wing. Work will include an upgrade of HVAC, electrical systems, and installation of a sprinkler system. Initially, four bays on the west end of the Chemical Wing will be renovated

and designed for expansion and tie-in with succeeding bays to minimize disruption of research during construction.

ERRC Modernization. In FY 1993, a facility condition study was completed to identify deficiencies in the Main Laboratory and Service buildings. The findings indicated that the utilities and building infrastructure had generally reached the end of their useful life, and that in the past 50 years the facility itself has been overtaken by the evolution of codes, ARS requirements, and research needs.

The modernization program involves nine phases; two in the Service building for the basic power plant requirements (phase 1 was completed in FY 1996); two in the Engineering Research Laboratory; and five in the Chemical Wing. The total planning, design, and construction budget is estimated at $39 million over nine years. The Agency received $5 million in FY 1998 to fund construction of phases 3 and 4 (Chemical Wing Laboratory). ARS also received $3.3 million in FY 1999 to fund phase 5 (Chemical Wing Laboratory), which does not include project work required on the Administration Wing and other buildings. In FY 2000, $4.4 million will be needed for construction of phase 6 (Chemical Wing Laboratory).

SRRC Modernization. After completion of the Chemical Wing, the remaining elements of SRRC modernization include the Administration, Textile and Industrial Wings. It is estimated that the cost to modernize the Industrial Wing will be $21 million for the five phases of construction. In FY 1998, $1.1 million was appropriated to begin design; $6 million was appropriated for continuation of phase 1 in FY 1999. In FY 2000, ARS is requesting $5.5 million for construction of phases 2 and 3 (Industrial Wing).

c) An increase of $8,200,000 for the modernization of the **Plum Island Animal Disease Center**, Greenport, New York.

The Plum Island Animal Disease Center (PIADC) is located on a Federally owned 840 acre island located about two miles off the eastern tip of Long Island, New York. Established by an Act of Congress in 1948, the former Fort Terry facility complex was transferred to USDA from the Department of Defense.

Plum Island is a unique national and hemispheric resource conducting state-of-the-art research and diagnostic work on foreign animal diseases that are an ongoing threat to U. S. livestock. Plum Island is the only site in the U.S. authorized by Congress to carry out research on foot and mouth disease and other highly contagious animal diseases. There are no alternative Federal or non-Federal mainland sites available with adequate biocontainment facilities to conduct this research.

APHIS' foreign animal disease diagnostic program is also located at PIADC. The Center places a high priority on the development of alternative disease control strategies that comply with animal welfare, ground water, and air pollution standards, as well as hazards of chemicals and pesticides. Major renovation of the Center is needed to ensure high quality research and biosafety.

In 1989, ARS and APHIS began to develop an overall long range plan for the repair and maintenance of the 23 buildings and supporting infrastructure. An architectural-engineering firm completed a detailed study of the condition and code deficiencies of the facility that totaled an estimated $90 million to correct. Insufficient funding levels have resulted in increased construction costs.

In FY 2000, ARS proposes an increase of $8.2 million for PIADC to provide for the continuation of the phased plan to modernize the Center. Major deficiencies to be corrected include environmental, civil, mechanical, electrical, architectural, and structural engineering types of work. Specific projects to be addressed in FY 2000 include:

Replace Boiler Plant. The 1990 facility deficiency study pointed out numerous deficiencies in the existing power plant. Besides numerous structural problems, the existing boilers are in an advanced state of deterioration. In FY 1996, a design was begun to replace the existing plant. In FY 1999, $2.7 million was appropriated for construction of phase 1. In FY 2000, ARS is requesting $3.2 million for construction of phase 2.

Sewage Decontamination Plant. In FY 1997, $500,000 was appropriated to design a replacement Sewage Decontamination Plant. In FY 1999, ARS anticipates receiving $3.5 million from APHIS to begin construction of phase 1. In FY 2000, ARS is requesting an additional $3 million to begin construction of phase 2, the final phase.

Miscellaneous Small Projects/Contingency. The design and construction of small modernization projects, environmental remediation activities, contingencies, and support costs are estimated in FY 2000 at $2 million.

d) An increase of $9,000,000 for construction of the Western Human Nutrition Research Center, (WHNRC), Davis, California.

The mission of the Western Human Nutrition Research Center (WHNRC) is to conduct research on human nutritional needs with emphasis on developing ways to measure them, and to assess nutritional status in large populations, and to develop new interventions. The research directly supports the National Health and Nutrition Examination Surveys conducted jointly by USDA, FDA, and the Centers for Disease Control, and the Federal Food Assistance Programs.

WHNRC, created by Congress in 1980, is located in the Letterman Army Institute of Research (LAIR) building at the Presidio in San Francisco. In October 1994, the Presidio was transferred to the National Park Service and became part of the Golden Gate National Recreation Area.

Due to the anticipated multi-fold increase in space payments to the Golden Gate National Recreational Area, ARS has negotiated an agreement with the National Park Service to remain at the LAIR facility (using about 37,000 g.s.f.) until April 30, 1999. ARS has identified space at the University of California Davis to house employees until a new facility is constructed. ARS has decided to relocate WHNRC to Davis, California, which is 72 miles northeast of San Francisco where it proposes to construct a replacement facility on the campus of the University of California. A minimum of 49,000 g.s.f. of laboratory and office space will be provided. The facility will include specialized laboratories, a metabolic research unit, clean room spaces, analytical chemistry laboratories, clinical laboratories, a computer laboratory, and support space. The total project cost (planning, design, and construction) is estimated at $20.35 million, of which $11.35 million has been appropriated to date for the full design costs of $1.7 million and $9.65 million for partial costs of construction.

Agricultural Research Service
Status of Construction Projects as of December, 1998

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 1999 Explanatory Notes, is as follows:

NOTE: Design criteria, provided by ARS, specifies the program requirements for the facility and forms the basis for negotiation of architect-engineer contracts. Diagrammatic drawings or concept drawings provide the basis for the first review of the architect's design. Tentative drawings or architect's design are provided by the architect for firming up cost estimates and basis for developing the completed, and final working drawings.

Location and Purpose	Year	Amount of Funds Provided	Description
Arizona, Maricopa	1995 Planning	$ 396,000	Project scope, budget, and schedule are on hold
Water Conservation	1999 Planning	500,000	until sufficient funding is identified to start the
and Western Cotton	Total	896,000	design process. In the interim, the agency will be
Laboratory			conducting a further review to determine the most cost-efficient size and capacity of the proposed replacement facility for the water conservation and cotton research program, as directed by the Congress.
California, Albany	1994 Planning and		Construction of Phase 7 is scheduled for completion
Western Regional	Construction	$ 1,161,000	in the Second Quarter of FY 1999. This will complete
Research Center	1995 Construction	919,000	the modernization of the North Wing. Funds for the design
	1997 Construction	4,000,000	of the modernization of the Research and Development
	Total	6,080,000	Facility are requested in FY 2000.
California, Davis	1998 Planning and		Pre-design and design contract will be awarded in the
Western Human Nutrition	Design	$ 1,700,000	Second Quarter of FY 1999 for completion by the
Research Center	1998 Construction	3,500,000	Fourth Quarter of FY 2000. Additional funds required for full
	1999 Construction	6,150,000	construction of the new facility are requested in FY 2000.
	Total	11,350,000	

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
California, Parlier	1993 Planning	$ 300,000	Construction of the new facility is scheduled for completion in the Second Quarter of FY 2000.
Horticultural Crop	1994 Planning	2,630,000	
Research Laboratory	1995 Construction	2,630,000	
and Water Management	1998 Construction	23,400,000	
Research Laboratory	Total	28,960,000	
Florida, Ft. Pierce	1994 Planning	$ 2,900,000	Farm site is scheduled for completion in the Second Quarter of FY 1999. Laboratory Building is scheduled for completion in the Fourth Quarter of FY 1999.
Horticultural Research	1995 Construction	2,900,000	
Laboratory	1996 Construction	1,500,000	
	1997 Construction	27,000,000	
	Total	34,300,000	
Georgia, Athens	1992 Planning	$ 400,000	This project is on hold due to uncertainty of planning and construction funds.
Poultry Disease	1993 Construction	677,000	
Laboratory	Total	1,077,000	
Hawaii, Hilo	1999 Planing and		Pre-design and design of the Main Laboratory and Rearing Facility is scheduled for award in the Fourth Quarter of FY 1999, for completion by the Fourth Quarter of FY 2000.
U.S. Pacific Basin	Design	$ 4,500,000	
Research Center			

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
Illinois, Peoria	1992 Planning	$ 1,825,000	Design of Segment 3 construction of the Pilot Plant
National Center for	1993 Planning	1,545,000	is scheduled for completion in the Fourth Quarter of
Agricultural	1996 Construction	3,900,000	FY 1999. Funds for the design of the Chemical Wing
Utilization Research	1997 Construction	1,500,000	modernization are requested in FY 2000.
	1998 Modernization	8,000,000	
	1999 Modernization	8,200,000	
	Total	24,970,000	
Iowa, Ames	1999 Modernization	2,957,000	Design contract for the Waste Water Treatment Plant is
National Animal	1999 Reprogramming	1,943,000	scheduled for award in the Second Quarter of FY 1999.
Disease Center	Total	4,900,000	The 1999 Appropriations Act directs the reprogramming of these funds to finance modernization activities at the NADC.
Kansas, Manhattan	1995 Planning	$ 950,000	Design for the renovation of the facility was completed
U.S. Grain Marketing	1996 Construction	1,000,000	in FY 1998. Construction of Phases 1 and 2 will be
Research Laboratory	1997 Construction	500,000	awarded in the Third Quarter of FY 1999.
	1999 Construction	1,400,000	
	Total	3,850,000	
Louisiana, New Orleans	1992 Construction	$ 1,950,000	The modernization of the Chemical Wing is complete. The
Southern Regional	1993 Planning and		design of the Industrial Wing, which is the next phase of
Research Center	Construction	1,651,000	modernization is scheduled for completion in the Second
	1994 Construction	2,667,000	Quarter of FY 1999. Phase 1 construction of the Industrial
	1995 Construction	2,934,000	Wing is scheduled for award in the Third Quarter of FY 1999.
	1996 Construction	900,000	Funds for the construction of Phases 2 and 3 of the Industrial
	1998 Design	1,100,000	Wing are requested in FY 2000.
	1999 Modernization	6,000,000	
	Total	17,202,000	

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided		Description
Maryland, Beltsville	1988 Modernization	$ 5,750,000		Ongoing Projects:
Beltsville Agricultural	1989 Modernization	6,100,000		1995 Funds:
Research Center	1990 Modernization	9,860,000		Construction:
(BARC)	1991 Modernization	15,999,792		-Construction of Building 004 modernization
	1992 Modernization	16,000,000		is scheduled for completion in the Second
	1993 Modernization	13,547,000		Quarter of FY 1999.
	1994 Modernization	19,700,000	*	
	1995 Modernization	3,960,000		1996 Funds:
	1996 Modernization	8,000,000		Construction:
	1997 Modernization	4,500,000		-Construction of the Controlled Environmental
	1998 Modernization	3,200,000		Facility is scheduled for completion in the Second
	1999 Modernization	2,500,000		Quarter of FY 1999.
	Total	109,116,792		

* Appropriated under USDA Rental Payments Account.

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
Maryland, Beltsville (cont'd) BARC			1997 Funds: Design: - Design of the Beltsville Human Nutrition Research Center (BHNRC) is scheduled for completion in the Second Quarter of FY 2000. Construction: - Construction of the BARC-East infrastructure system is scheduled for completion in the Second Quarter FY 1999. 1998 Funds: Design: - Pre-Design contract for the Design/Build of the Feed Center was awarded in the First Quarter of FY 1999. Full Design/Build contract is scheduled for award in the First Quarter of FY 1999. Construction: - Construction of the Fiber Optic Backbone cable is scheduled for completion in the Second Quarter of FY 1999. 1999 Funds: Design: - Design of a new Poultry Production facility is scheduled for award in the Third Quarter of FY 1999 for completion by the Third Quarter of FY 2000. Construction: - Construction is scheduled for award in the Fourth Quarter of FY 2000.

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
Maryland, Beltsville (cont'd) BARC			2000 Request: Construction: - Funds for construction of Phase 1 of the Beltsville Human Nutrition Research Center are requested in FY 2000.
National Agricultural Library	1998 Modernization 1999 Modernization Total	$ 2,500,000 1,200,000 3,700,000	Design for Phase 1 of the multi-phase modernization of NAL is complete. Construction contract was awarded in the Fourth Quarter of FY 1998 for completion by the First Quarter of FY 2000. Construction of Phase 1 of the replacement of the Air Handling Unit is scheduled for completion in the Fourth Quarter of FY 1999. Construction of Phase 2 of the replacement of the Air Handling Unit is scheduled for award in the First Quarter of FY 2000 for completion by the Fourth Quarter of FY 2000.
Michigan, East Lansing Avian Disease and Oncology Lab	1992 Planning 1993 Planning 1998 Planning and Design Total	$ 250,000 212,000 1,800,000 2,262,000	Design of the replacement facility is scheduled for completion in the Second Quarter of FY 2000.

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided		Description
Mississippi, Oxford	1988 Feasibility			ARS funds appropriated for this state facility have been
National Center for	and Planning	$ 50,000	a/	transferred to CSREES for grant award to the Univ. of
Natural Products	1989 Planning	400,000	a/	Mississippi for construction of the National Center for Natural
Animal Facilities.	1990 Planning and			Products.
	Construction	3,875,000	b/	
	1991 Construction	5,174,933	a/	
	1992 Construction	5,175,000	a/	
	1993 Construction	4,382,000	a/	
	1994 Construction	4,382,000	a/	
	1995 Construction	3,578,000	a/	
	1996 Construction	1,500,000	a/	
	1998 Construction	7,000,000	a/	
	Total	35,516,933		
Mississippi, Stoneville	1998 Planning and			Design contract is scheduled for award in the Second
Biocontrol and Insect	Design	$ 900,000		Quarter of FY 1999 for completion by the Second Quarter
	1999 Planning and			of FY 2001.
	Design	200,000		
	Total	1,100,000		

a/ Appropriated to ARS and transferred to CSREES.
b/ Appropriated to CSREES.

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
Montana, Sidney	1998 Planning and Design	$ 606,000	Planning and design of the new facility is scheduled for completion in the Fourth Quarter of FY 1999.
Pest Quarantine and Integrated Pest Mgmt.	1999 Construction	7,300,000	
	Total	7,906,000	
New Mexico, Las Cruces	1998 Planning and Design	$ 700,000	Design for the replacement facility is scheduled for completion in the Fourth Quarter of FY 1999.
Jornada Range Research Station	1999 Construction	6,700,000	Construction contract is scheduled for award in the First Quarter of FY 2000 for completion by the Second Quarter of FY 2001.
	Total	7,400,000	
New York, Greenport	1993 Design and Construction	$ 2,540,000	Design for repair of the Sewage Decontamination Plant is scheduled for award in the Third Quarter of FY 1999. The Waste Water Treatment project is on hold pending resolution of remediation request with EPA/DEC. Replacement of various electrical distribution systems will be completed in the Fourth Quarter of FY 1999. Boiler Plant Replacement Design is scheduled for completion in the Third Quarter of FY 1999. Additional funds to complete construction of the Boiler Plant Replacement, Sewage Decontainmination Plant and for miscellaneous projects are requested in FY 2000.
Plum Island Animal Disease Center	1994 Construction	1,475,000	
	1995 Construction	1,168,000	
	1996 Design and Construction	5,000,000	
	1997 Construction	5,000,000	
	1998 Construction	2,000,000	
	1999 Modernization	3,500,000	
	Total	20,683,000	

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
North Dakota, Grand Forks Human Nutrition Research Center	1998 Construction	$ 4,400,000	Full restoration of the Human Nutrition Research Center is scheduled for completion in the Second Quarter of FY 1999.
Pennsylvania, Wyndmoor Eastern Regional Research Center	1997 Construction 1998 Modernization 1999 Modernization Total	$ 4,000,000 5,000,000 3,300,000 12,300,000	Modernization of facilities will be accomplished in nine phases. Construction of Phase 1 (Power Plant) is complete. Phase 2 construction of the Engineering Research Laboratory (Pilot Plant) is scheduled for completion in the Third Quarter of FY 1999. Construction of Phases 3 and 4 (Chemical Wing Laboratory) is scheduled for completion in the First Quarter of FY 2001. Phase 5 construction (Chemical Wing Laboratory) is scheduled for award in the First Quarter of FY 2001. Funds for construction of Phase 6 (Chemical Wing Laboratory) are requested in FY 2000.
South Carolina, Charleston U.S. Vegetable Laboratory	1988 Feasibility 1990 Planning and Construction 1994 Construction 1995 Construction 1996 Construction 1997 Construction 1998 Construction Total	$ 50,000 1,135,000 909,000 5,544,000 3,000,000 3,000,000 4,824,000 18,462,000	Design for the replacement facility is complete. Construction contract for Phase 1 of the two-phased project is scheduled for award in the Second Quarter of FY 1999 for completion by the Second Quarter of FY 2001.

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
Texas, Lubbock	1978 Feasibility	$ 100,000	Completion of the Laboratory/Office Building is
Plant Stress and	1979 Planning	800,000	scheduled in the Second Quarter of FY 1999.
Water Conservation	1984 Planning	500,000	
Laboratory	1990 Construction	500,000	
	1991 Planning	599,992	
	1992 Construction	1,300,000	
	1993 Construction	1,101,000	
	1994 Construction	551,000	
	1995 Construction	1,051,000	
	1996 Construction	1,500,000	
	1997 Construction	8,100,000	
	Total	16,102,992	
Texas, Weslaco	1994 Planning	$ 1,400,000	Completion of the Laboratory/Office Building
Subtropical Agricultural	1995 Construction	3,009,000	and Greenhouses is scheduled in the Fourth Quarter
Research Laboratory	1996 Construction	1,000,000	of FY 1999. Other phases of modernization will be
	1996 Reprogramming		undertaken as funds become available.
	1997 Construction	4,000,000	
	Total	9,792,000	
Utah, Logan	1998 Planning and		Planning and design contract will be awarded in
Poisonous Plant	Design	$ 600,000	theSecond Quarter of FY 1999 for completion by
Laboratory	1999 Planning and		the First Quarter of FY 2000.
	Design	30,000	
	Total	630,000	

Status of Construction Projects as of December, 1998 (cont'd)

Location and Purpose	Year	Amount of Funds Provided	Description
West Virginia, Leetown	1995 Planning	$ 1,921,000	Design of the new facility is scheduled for completion
National Center for Cool	1997 Construction	6,000,000	in the Second Quarter of FY 1999. Construction is
and Cold Water	1998 Construction	6,000,000	scheduled for award in the Third Quarter of FY 1999 for
Aquaculture	1999 Construction	2,000,000	completion by the Fourth Quarter of FY 2000.
	Total	15,921,000	
Montpellier, France	1993 Design	$ 500,000	Completion of the new facility is scheduled in the Fourth
European Biological	1993 Construction	470,000	Quarter of FY 1999.
Control Laboratory	1998 Construction	3,400,000	
	Total	4,370,000	